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Development Document for Effluent Limitations Guidelines and Standards for the Nonferrous Metals Manufacturing Point Source Category. Volume 5. Primary Precious Metals and Mercury Secondary Precious Metals, Secondary Silver, Secondary Mercury

(U.S.) Environmental Protection Agency, Washington, DC

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Abstract: Contents: Subcategory profile; Subcategorization; Water use and wastewater characteristics; Selection of pollutant parameters, Control and treatment technologies; Costs, energy, and nonwater quality aspects; Best practicable control technology current available; Best available technology economically achievable; New source performance standards; Pretreatment standards; Best conventional pollutant control technology.

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Office of Water Regulations
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Industrial Technology Division
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Office of Water

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EPA

Development Document for Effluent Limitations Guidelines and Standards for the Nonferrous Metals Manufacturing Point Source Category

FINAL

Volume V

Primary Precious Metals and Mercury
Secondary Precious Metals
Secondary Silver
Secondary Mercury

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SPRINGFIELD, VA. 22161

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ORGANIZATION OF THIS DOCUMENT

This development document for the nonferrous metals manufacturing category consists of a general development document which considers the general and overall aspects of the regulation and 31 subcategory specific supplements. These parts are organized into 10 volumes as listed below.

The information in the general document and in the supplements is organized by sections with the same type of information reported in the same section of each part. Hence to find information on any specific aspect of the category one would need only look in the same section of the general document and the specific supplements of interest.

The ten volumes contain contain the following subjects:

Volume I	General Development Document
Volume II	Bauxite Refining Primary Aluminum Smelting Secondary Aluminum Smelting
Volume III	Primary Copper Smelting Primary Electrolytic Copper Refining Secondary Copper Refining Metallurgical Acid Plants
Volume IV	Primary Zinc Primary Lead Secondary Lead Primary Antimony
Volume V	Primary Precious Metals and Mercury Secondary Precious Metals Secondary Silver Secondary Mercury
Volume VI	Primary Tungsten Secondary Tungsten and Cobalt Primary Molybdenum and Rhenium Secondary Molybdenum and Vanadium
Volume VII	Primary Beryllium Primary Nickel and Cobalt Secondary Nickel Secondary Tin
Volume VIII	Primary Columbium and Tantalum Secondary Tantalum Secondary Uranium
Volume IX	Primary and Secondary Titanium Primary Zirconium and Hafnium
Volume X	Primary and Secondary Germanium and Gallium Primary Rare Earth Metals Secondary Indium

DEVELOPMENT DOCUMENT

for

EFFLUENT LIMITATIONS GUIDELINES AND STANDARDS

for the

NONFERROUS METALS MANUFACTURING POINT SOURCE CATEGORY

VOLUME V

Primary Precious Metals and Mercury
Secondary Precious Metals
Secondary Silver
Secondary Mercury

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For detailed contents see detailed contents list in individual supplement.

NONFERROUS METALS MANUFACTURING POINT SOURCE CATEGORY

DEVELOPMENT DOCUMENT SUPPLEMENT

for the

Primary Precious Metals and Mercury Subcategory

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PRIMARY PRECIOUS METALS AND MERCURY SUBCATEGORY

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SECTION I

SUMMARY

This document provides the technical basis for promulgating effluent limitations based on best practicable technology (BPT) and best available technology (BAT) for existing direct dischargers, pretreatment standards for new indirect dischargers (PSNS), and standards of performance for new source direct dischargers (NSPS) for plants in the primary precious metals and mercury subcategory.

The primary precious metals and mercury subcategory is comprised of eight plants. Of the eight plants, one discharges directly to rivers, lakes, or streams; none discharge to publicly owned treatment works (POTW); and seven achieve zero discharge of process wastewater.

EPA first studied the primary precious metals and mercury subcategory to determine whether differences in raw materials, final products, manufacturing processes, equipment, age and size of plants, and water usage, required the development of separate effluent limitations and standards for different segments of the subcategory. This involved a detailed analysis of wastewater discharge and treated effluent characteristics, including the sources and volume of water used, the processes used, the sources of pollutants and wastewaters in the plant, and the constituents of wastewaters, including priority pollutants. As a result, nine subdivisions have been identified for this subcategory that warrant separate effluent limitations. These include:

1. Smelter wet air pollution control,
2. Silver chloride reduction spent solution,
3. Electrolytic cells wet air pollution control,
4. Electrolyte preparation wet air pollution control,
5. Calciner wet air pollution control,
6. Calciner quench water,
7. Calciner stack gas contact cooling water,
8. Condenser blowdown, and
9. Mercury cleaning bath water

Several distinct control and treatment technologies (both in-plant and end-of-pipe) applicable to the primary precious metals and mercury subcategory were identified. The Agency analyzed both historical and newly generated data on the performance of these technologies, including their nonwater quality environmental impacts and air quality, solid waste generation, and energy requirements. EPA also studied various flow reduction techniques reported in the data collection portfolios (dcp) and plant visits.

Engineering costs were prepared for each of the control and treatment options considered for the subcategory. These costs were then used by the Agency to estimate the impact of implementing the various options on the subcategory. For each control and treatment option that the Agency found to be most effective and technically feasible in controlling the discharge of pollutants, the number of potential closures, number of employees affected, and impact on price were estimated. These results are reported in a separate document entitled "The Economic Impact Analysis of Effluent Limitations and Standards for the Nonferrous Metals Manufacturing Industry."

After examining the various treatment technologies, the Agency has identified BPT to represent the average of the best existing technology in the nonferrous metals manufacturing industry. Metals removal based on chemical precipitation and sedimentation and ion exchange technology is the basis for the BPT limitations. Oil skimming was selected as the technology basis for oil and grease limitations. To meet the BPT effluent limitations based on this technology, the primary precious metals and mercury subcategory is expected to incur a capital cost of $42,200 and an annual cost of $26,800.

For BAT, the Agency has built upon the BPT technology basis by adding in-process control technologies which include recycle of process water from air pollution control waste streams. Filtration is added as an effluent polishing step to the end-of-pipe treatment scheme. To meet the BAT effluent limitations based on this technology, the primary precious metals and mercury subcategory is estimated to incur a capital cost of $43,025 and an annual cost of $27,300.

NSPS are equivalent to BAT. In selecting NSPS, EPA recognizes that new plants have the opportunity to implement the best and most efficient manufacturing processes and treatment technology. As such, the technology basis of BAT has been determined as the best demonstrated technology.

EPA is not promulgating PSES for the primary precious metals and mercury subcategory because there are no indirect dischargers. For PSNS, the Agency selected end-of-pipe treatment and in-process flow reduction control techniques equivalent to NSPS.

The best conventional technology (BCT) replaces BAT for the control of conventional pollutants. BCT is not being promulgated because the methodology for BCT has not yet been finalized.

The mass limitations and standards for BPT, BAT, NSPS, and PSNS are presented in Section II.

SECTION II

CONCLUSIONS

EPA has divided the primary precious metals and mercury subcategory into nine subdivisions or building blocks for the purpose of effluent limitations and standards. These subdivisions are:

(a) Smelter wet air pollution control,
(b) Silver chloride reduction spent solution,
(c) Electrolytic cells wet air pollution control,
(d) Electrolyte preparation wet air pollution control,
(e) Calciner wet air pollution control,
(f) Calcine quench water,
(g) Calciner stack gas contact cooling water,
(h) Condenser blowdown, and
(i) Mercury cleaning bath water.

BPT is promulgated based on the performance achievable by the application of chemical precipitation and sedimentation technology (lime and settle) and ion exchange as a polishing step technology along with preliminary treatment consisting of oil skimming for selected waste streams. The following BPT effluent limitations are promulgated:

(a) Smelter Wet Air Pollution Control BPT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of gold and silver smelted		
Lead	0.546	0.260
Mercury	0.325	0.130
Silver	0.533	0.221
Zinc	1.898	0.793
Gold	0.130	--
Oil and grease	26.000	15.600
Total suspended solids	53.300	25.350
pH	Within the range of 7.5 to 10.0 at all times	

(b) Silver Chloride Reduction Spent Solution BPT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver reduced in solution		
Lead	0.168	0.080
Mercury	0.100	0.040
Silver	0.164	0.068
Zinc	0.584	0.244
Gold	0.040	--
Oil and grease	8.000	4.800
Total suspended solids	16.400	7.800
pH	Within the range of 7.5 to 10.0 at all times	

(c) Electrolytic Cells Wet Air Pollution Control BPT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of gold refined electrolytically		
Lead	83.160	39.600
Mercury	49.500	19.800
Silver	81.180	33.660
Zinc	289.100	120.800
Gold	19.800	--
Oil and grease	3,960.000	2,376.000
Total suspended solids	8,118.000	3,861.000
pH	Within the range of 7.5 to 10.0 at all times	

(d) Electrolyte Preparation Wet Air Pollution Control BPT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver in electrolyte produced		
Lead	0.021	0.010
Mercury	0.013	0.005
Silver	0.021	0.009
Zinc	0.073	0.031
Gold	0.005	--
Oil and grease	1.000	0.600
Total suspended solids	2.050	0.975
pH	Within the range of 7.5 to 10.0 at all times	

(e) Calciner Wet Air Pollution Control BPT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of mercury condensed		
Lead	78.200	37.240
Mercury	46.550	18.620
Silver	76.3?0	31.650
Zinc	271.900	113.600
Gold	18.600	--
Oil and grease	3,724.000	2.234.000
Total suspended solids	7,634.000	3,631.000
pH	Within the range of 7.5 to 10.0 at all times	

(f) Calcine Quench Water BPT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of mercury condensed		
Lead	7.392	3.520
Mercury	4.400	1.760
Silver	7.216	2.992
Zinc	25.700	10.740
Gold	1.760	--
Oil and grease	352.000	211.200
Total suspended solids	721.600	343.200
pH	Within the range of 7.5 to 10.0 at all times	

(g) Calciner Stack Gas Contact Cooling Water BPT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of mercury condensed		
Lead	1.743	0.830
Mercury	1.038	0.415
Silver	1.702	0.706
Zinc	6.059	2.532
Gold	0.415	--
Oil and grease	83.000	49.800
Total suspended solids	170.200	80.930
pH	Within the range of 7.5 to 10.0 at all times	

(h) Condenser Blowdown BPT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of mercury condensed		
Lead	5.796	2.760
Mercury	3.350	1.380
Silver	5.658	2.346
Zinc	20.150	8.418
Gold	1.380	--
Oil and grease	276.000	165.600
Total suspended solids	565.800	269.100
pH	Within the range of 7.5 to 10.0 at all times	

(i) Mercury Cleaning Bath Water BPT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of mercury condensed		
Lead	0.588	0.280
Mercury	0.350	0.140
Silver	0.574	0.238
Zinc	2.044	0.854
Gold	0.140	--
Oil and grease	28.000	16.800
Total suspended solids	57.400	27.300
pH	Within the range of 7.5 to 10.0 at all times	

BAT is promulgated based on the performance achievable by the application of chemical precipitation, sedimentation, and multimedia filtration (lime, settle, and filter) and ion exchange end-of-pipe polishing treatment technology and in-process flow reduction methods, along with preliminary treatment consisting of oil skimming for selected waste streams. The following BAT effluent limitations are promulgated:

(a) Smelter Wet Air Pollution Control BAT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of gold and silver smelted		
Lead	0.364	0.169
Mercury	0.195	0.078
Silver	0.377	0.156
Zinc	1.326	0.546
Gold	0.130	--

(b) Silver Chloride Reduction Spent Solution BAT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver reduced in solution		
Lead	0.112	0.052
Mercury	0.060	0.024
Silver	0.116	0.048
Zinc	0.408	0.168
Gold	0.040	--

(c) Electrolytic Cells Wet Air Pollution Control BAT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of gold refined electrolytically		
Lead	5.544	2.574
Mercury	2.970	1.188
Silver	5.742	2.376
Zinc	20.200	8.316
Gold	1.980	--

(d) Electrolyte Preparation Wet Air Pollution Control BAT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver in electrolyte produced		
Lead	0.014	0.0065
Mercury	0.0075	0.0030
Silver	0.015	0.0060
Zinc	0.051	0.021
Gold	0.005	--

(e) Calciner Wet Air Pollution Control BAT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of mercury condensed		
Lead	6.160	2.860
Mercury	3.300	1.320
Silver	6.380	2.640
Zinc	22.440	9.240
Gold	2.200	--

(f) Calcine Quench Water

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of mercury condensed		
Lead	4.928	2.288
Mercury	2.640	1.056
Silver	5.104	2.112
Zinc	17.950	7.392
Gold	1.760	--

(g) Calciner Stack Gas Contact Cooling Water BAT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of mercury condensed		
Lead	1.162	0.540
Mercury	0.623	0.249
Silver	1.204	0.498
Zinc	4.233	1.743
Gold	0.415	--

(h) Condenser Blowdown

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of mercury condensed		
Lead	3.864	1.794
Mercury	2.070	0.828
Silver	4.002	1.656
Zinc	14.080	5.796
Gold	1.380	--

(i) Mercury Cleaning Bath Water BAT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of mercury condensed		
Lead	0.392	0.182
Mercury	0.210	0.084
Silver	0.406	0.168
Zinc	1.428	0.588
Gold	0.140	--

NSPS are promulgated based on the performance achievable by the application of chemical precipitation, sedimentation, and multimedia filtration (lime, settle, and filter) and ion exchange as a polishing step technology, and in-process flow reduction control methods, along with preliminary treatment consisting of oil skimming for selected waste streams. The following effluent standards are promulgated for new sources:

(a) Smelter Wet Air Pollution Control NSPS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of gold and silver smelted		
Lead	0.364	0.169
Mercury	0.195	0.078
Silver	0.377	0.156
Zinc	1.326	0.546
Gold	0.130	--
Oil and grease	13.000	13.000
Total suspended solids	19.500	15.600
pH	Within the range of 7.5 to 10.0 at all times	

(b) Silver Chloride Reduction Spent Solution NSPS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver reduced in solution		
Lead	0.112	0.052
Mercury	0.060	0.024
Silver	0.116	0.048
Zinc	0.408	0.168
Gold	0.000	--
Oil and grease	4.000	4.000
Total suspended solids	6.000	4.800
pH	Within the range of 7.5 to 10.0 at all times	

(c) Electrolytic Cells Wet Air Pollution Control NSPS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of gold refined electrolytically		
Lead	5.544	2.574
Mercury	2.970	1.188
Silver	5.742	2.376
Zinc	20.200	8.316
Gold	1.980	--
Oil and grease	198.000	198.000
Total suspended solids	297.000	237.600
pH	Within the range of 7.5 to 10.0 at all times	

(d) Electrolyte Preparation Wet Air Pollution Control NSPS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver in electrolyte produced		
Lead	0.014	0.0065
Mercury	0.0075	0.0030
Silver	0.015	0.0060
Zinc	0.051	0.021
Gold	0.005	--
Oil and grease	0.500	0.500
Total suspended solids	0.750	0.600
pH	Within the range of 7.5 to 10.0 at all times	

(e) Calciner Wet Air Pollution Control NSPS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of mercury condensed		
Lead	6.160	2.860
Mercury	3.300	1.320
Silver	6.380	2.640
Zinc	22.440	9.240
Gold	2.200	--
Oil and grease	220.000	220.000
Total suspended solids	330.000	264.000
pH	Within the range of 7.5 to 10.0 at all times	

(f) Calciner Quench Water NSPS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of mercury condensed		
Lead	4.928	2.288
Mercury	2.640	1.056
Silver	5.104	2.112
Zinc	17.950	7.392
Gold	1.760	--
Oil and grease	176.000	176.000
Total suspended solids	264.000	211.200
pH	Within the range of 7.5 to 10.0 at all times	

(g) Calciner Stack Gas Contact Cooling Water NSPS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of mercury condensed		
Lead	1.162	0.540
Mercury	0.623	0.249
Silver	1.204	0.498
Zinc	4.233	1.743
Gold	0.415	--
Oil and grease	41.500	41.500
Total suspended solids	62.250	49.800
pH	Within the range of 7.5 to 10.0 at all times	

(h) Condenser Blowdown NSPS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of mercury condensed		
Lead	3.864	1.794
Mercury	2.070	0.828
Silver	4.002	1.656
Zinc	14.080	5.796
Gold	1.380	--
Oil and grease	138.000	138.000
Total suspended solids	207.000	165.600
pH	Within the range of 7.5 to 10.0 at all times	

(i) Mercury Cleaning Bath Water NSPS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of mercury condensed		
Lead	0.392	0.182
Mercury	0.210	0.084
Silver	0.406	0.168
Zinc	1.428	0.588
Gold	0.140	--
Oil and grease	14.000	14.000
Total suspended solids	21.000	16.800
pH	Within the range of 7.5 to 10.0 at all times	

EPA is not promulgating PSES for the primary precious metals and mercury subcategory because there are no indirect dischargers.

PSNS are promulgated based on the performance achievable by the application of chemical precipitation, sedimentation, and multimedia filtration (lime, settle, and filter) and ion exchange as a polishing step technology, and in-process flow reduction control methods, along with preliminary treatment consisting of oil skimming for selected waste streams. The following pretreatment standards are promulgated for new sources:

(a) Smelter Wet Air Pollution Control PSNS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of gold and silver smelted		
Lead	0.364	0.169
Mercury	0.195	0.078
Silver	0.377	0.156
Zinc	1.326	0.546
Gold	0.130	---

(b) Silver Chloride Reduction Spent Solution PSNS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver reduced in solution		
Lead	0.112	0.052
Mercury	0.060	0.024
Silver	0.116	0.048
Zinc	0.408	0.168
Gold	0.040	--

(c) Electrolytic Cells Wet Air Pollution Control PSNS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of gold refined electrolytically		
Lead	5.544	2.574
Mercury	2.970	1.188
Silver	5.742	2.376
Zinc	20.200	8.316
Gold	1.980	--

(d) Electrolyte Preparation Wet Air Pollution Control PSNS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver in electrolyte produced		
Lead	0.014	0.0065
Mercury	0.0075	0.0030
Silver	0.015	0.0060
Zinc	0.051	0.021
Gold	0.005	--

(e) Calciner Wet Air Pollution Control PSNS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of mercury condensed		
Lead	6.160	2.860
Mercury	3.300	1.320
Silver	6.380	2.640
Zinc	22.440	9.240
Gold	2.200	--

(f) Calciner Quench Water PSNS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of mercury condensed		
Lead	4.928	2.288
Mercury	2.640	1.056
Silver	5.104	2.112
Zinc	17.950	7.392
Gold	1.760	--

(g) Calciner Stack Gas Contact Cooling Water PSNS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of mercury condensed		
Lead	1.162	0.540
Mercury	0.623	0.249
Silver	1.204	0.498
Zinc	4.233	1.743
Gold	0.415	--

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Mercury	2.070	0.828
Silver	4.002	1.656
Zinc	14.080	5.796
Gold	1.380	--

(i) Mercury Cleaning Bath Water PSNS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of mercury condensed		
Lead	0.392	0.182
Mercury	0.210	0.084
Silver	0.406	0.168
Zinc	1.428	0.588
Gold	0.140	--

EPA is not promulgating BCT for the primary precious metals and mercury subcategory at this time.

SECTION III

SUBCATEGORY PROFILE

This section of the primary precious metals and mercury supplement describes the raw materials and processes used in producing primary precious metals and mercury and presents a profile of the primary precious metals and mercury plants identified in this study. For a discussion of the purpose, authority, and methodology for this study, and a general description of the nonferrous metals manufacturing category, refer to Section III of Vol. I.

DESCRIPTION OF PRIMARY PRECIOUS METALS PRODUCTION

The production of primary precious metals can be divided into three distinct stages - smelting to produce Dore metal, or precipitation of silver from silver ore, separation of gold and silver, and gold and silver purification. The processes used in each stage vary with the type and purity of raw material used. The primary precious metals production process is presented schematically in Figure III-1 (page 2174) and described below.

RAW MATERIALS

Primary precious metals are produced from gold and silver bearing concentrates produced from precious metal ores and as by-products from the beneficiation of base metal ores. A small amount is also produced from placer mining operations. Precious metal ores are mined at various locations in the western United States.

Mining and beneficiation processes for precious metal-bearing ores, including cyanidation, amalgamation, flotation, and gravity concentration are outside of the scope of this subcategory. Both the mining and beneficiation operations are regulated as part of the Ore Mining and Dressing Point Source Category.

Primary precious metals produced as a by-product of primary copper electrolytic refining operations are regulated as part of the primary copper electrolytic refining subcategory. Primary precious metals produced as a by-product of other primary copper operations, such as solvent extraction, are regulated under these limitations.

SMELTING

The gold and silver manufacturing process begins when the precious metals bearing concentrate is sent through a Dore furnace (smelter). In the Dore furnace, the gold, silver, and other precious metals are smelted in the presence of a fluxing agent (commonly soda ash, borax, or silica). This smelting operation produces a slag containing impurities such as copper

Preceding page blank

and zinc, and a gold base alloy known as Dore, which may also contain silver. The Dore gold may be cast and sold as a product or be further refined.

SILVER PRECIPITATION

The silver manufacturing process may begin when silver is precipitated from a silver-copper ore which has been dissolved into solution. Silver is precipitated using sodium chloride. The silver chloride precipitate is then slurried in dilute acid, and reduced to silver metal in a cementation step. The silver produced may be sold as a product.

GOLD-SILVER SEPARATION

The separation of gold and silver from Dore bars is accomplished through electrolytic refining of the Dore bars or by the Miller process. In the electrolytic method, the Dore metal is cast into anodes and placed into a solution of silver nitrate (AgN_3) electrolyte. When a current is applied, fine silver is deposited upon the cathode. This silver is removed, washed, and cast into bars of fine silver for sale. Gold remains as slimes in the canvas anode bags. Gold slimes are washed with acid and rinsed with water before being cast into product ingots. This gold is about 99 percent pure. Silver is recovered in a cementation step from the silver crystals wash water and from the gold slimes acid wash and rinse water. In the cementation process, copper is added to the solution and replaces the silver, causing the silver to precipitate out of solution. The recovered silver is returned to the anode casting stage.

Gold and silver can also be separated from the Dore metal while it is still molten. This purification step is known as the Miller process and consists of bubbling chlorine gas through the molten Dore metal in a parting furnace. This process converts the silver into silver chloride salt and volatilizes base metal impurities. The silver chloride salt rises to the surface and is skimmed off for further processing. The gold produced by the Miller process can be further purified by electrolytic refining or immediately cast as a product. The silver chloride salt which is skimmed off is remelted and cast into slabs. These slabs are reduced to silver metal in an acid solution in a similar process to that described above under silver precipitation. The resulting silver metal is remelted in the presence of borax flux and molten silver is then cast into product ingots.

FURTHER PURIFICATION

After separation, gold and silver can be further refined by various means. One technique to further refine gold is electrolysis. Impure gold is cast into anodes and purified electrolytically by the Wholwill process in a chloride solution. Gold, which is oxidized at the anode, passes into solution and is deposited upon the cathode. The gold cathode is melted and cast into bars with a purity greater than 99.9 percent. As described above, gold slimes can be further purified using an acid wash and water rinse process.

PROCESS WASTEWATER SOURCES

Although a variety of processes are involved in primary precious metals production, the process wastewater sources can be subdivided as follows:

1. Smelter wet air pollution control,
2. Silver chloride reduction spent solution,
3. Electrolytic cells wet air pollution control, and
4. Electrolyte preparation wet air pollution control.

DESCRIPTION OF PRIMARY MERCURY PRODUCTION

Primary mercury is produced from mercury ores and gold-bearing ores by roasting or calcining. The primary mercury production process is presented schematically in Figure III-2 (page 2175) and described below.

RAW MATERIALS

The principal source of mercury is cinnabar ore (mercury sulfide). Cinnabar ore is mined primarily in Nevada, California, and Oregon. In addition, a small amount of mercury is recovered as a co-product from gold ore.

ROASTING

After mining and beneficiation, mercury is extracted from mercury-bearing ores by roasting or calcining. In the roasting process, the mercury is vaporized and then recovered in a condenser, while the sulfur is oxidized to SO_2. Some water may condense with the mercury and is discharged as a waste stream. The mercury recovered from the condenser may be washed with water prior to being sold. The mining and beneficiation stage of mercury production is not within the scope of this subcategory.

Sulfur dioxide (SO_2) and other gaseous emissions from the mercury roasting furnace are controlled with a multistage scrubber. Sulfur dioxide emissions are controlled with a wet scrubber. After SO_2 removal, the clean stack gases are cooled with contact cooling water and discharged to the atmosphere. Calciner SO_2 scrubber liquor and stack gas contact cooling water are discharged as waste streams.

PROCESS WASTEWATER SOURCES

Although a variety of processes are involved in primary mercury production, the process wastewater sources can be subdivided as follows:

1. Calciner wet air pollution control,
2. Calcine quench water,
3. Calciner stack gas contact cooling water,
4. Condenser blowdown, and
5. Mercury cleaning bath water.

OTHER WASTEWATER SOURCES

There are other waste streams associated with the primary precious metals and mercury subcategory. These waste streams may include casting contact cooling water, stormwater runoff, and maintenance and cleanup water. These waste streams are not considered as a part of this rulemaking. EPA believes that the flows and pollutant loadings associated with these waste streams are insignificant relative to the waste streams selected and are best handled by the appropriate permit authority on a case-by-case basis under authority of Section 402 of the Clean Water Act.

AGE, PRODUCTION, AND PROCESS PROFILE

Figure III-3 (page 2176) shows the location of the eight primary precious metals and mercury plants operating in the United States. Four of the eight plants are located in Nevada, with one of the remaining plants each being located in Idaho, Montana, Colorado, and South Dakota.

Table III-1 (page 2169) shows the relative age and discharge status of the primary precious metals and mercury plants. Seven of the eight plants in this subcategory have a zero discharge status, and one plant is a direct discharge facility. The average plant age is less than 12 years. Tables III-2 to III-4 (pages 2170-2172) provide a summary of the current production ranges. It can be seen that production of gold is evenly spread along the ranges with a mean production of 70,000 troy ounces/year. The mean production of silver is 222,500 troy ounces/year.

Table III-5 (page 2173) provides a summary of the number of plants generating wastewater for the waste streams associated with various processes and the number of plants with the process.

Table III-1

INITIAL OPERATING YEAR (RANGE) SUMMARY OF PLANTS IN THE PRIMARY PRECIOUS METALS AND MERCURY SUBCATEGORY BY DISCHARGE TYPE

	Initial Operating Year (Range) (Plant Age in Years)					
Type of Plant	1983-1973 (0-11)	1972-1968 (12-16)	1967-1958 (17-26)	1957-1918 (27-66)	Before 1918 (66%)	Total
Direct	1	0	0	0	0	1
Indirect	0	0	0	0	0	0
Zero	4	1	1	0	1	7
TOTAL	5	1	1	0	1	8

Table III-2

PRODUCTION RANGES FOR THE PRIMARY PRECIOUS METALS AND MERCURY SUBCATEGORY

Type of Plant	Gold Production Range for 1982			Total Number of Plants
	0-10,000 (troy oz./yr)	10,001-75,000 (troy oz./yr)	75,001-200,000 (troy oz./yr)	
Direct	1	0	0	1
Indirect	0	0	0	0
Zero	1	2	2	5
				6

Table III-3

PRODUCTION RANGES FOR THE PRIMARY PRECIOUS METALS AND MERCURY SUBCATEGORY

	Silver Production Range for 1982				
Type of Plant	0-10,000 (troy oz./yr)	10,001-50,000 (troy oz./yr)	50,001-500,000 (troy oz./yr)	>500,000 (troy oz./yr)	Total Number of Plants
Direct	0	0	1	0	1
Indirect	0	0	0	0	0
Zero	1	3	0	1	5
					6

Table III-4

PRODUCTION RANGES FOR THE PRIMARY PRECIOUS METALS AND MERCURY SUBCATEGORY

Mercury production ranges are not presented here because the information on which they are based has been claimed confidential.

Table III-5

SUMMARY OF PRIMARY PRECIOUS METALS AND MERCURY SUBCATEGORY PROCESSES AND ASSOCIATED WASTE STREAMS

Process or Waste Stream	Number of Plants With Process or Waste Stream	Number of Plants Reporting Generation of Wastewater*
Roasting	8	
(P.M.) Smelter wet air pollution control	5	3
(Hg) Calciner wet air pollution control	1	1
(Hg) Calcine quench	1	1
(Hg) Calciner stack gas cooling water	1	1
(Hg) Condenser blowdown	2	1
Gold-Silver Separation	3	
(P.M.) Electrolytic preparation wet air pollution control	1	1
Further Purification	3	
(P.M.) Silver chloride reduction spent solution	2	2
(P.M.) Electrolytic cells wet air pollution control	1	1
(Hg) Mercury cleaning bath water	1	1

---

*Through reuse or evaporation practices, a plant may "generate" a wastewater from a particular process but not discharge it.

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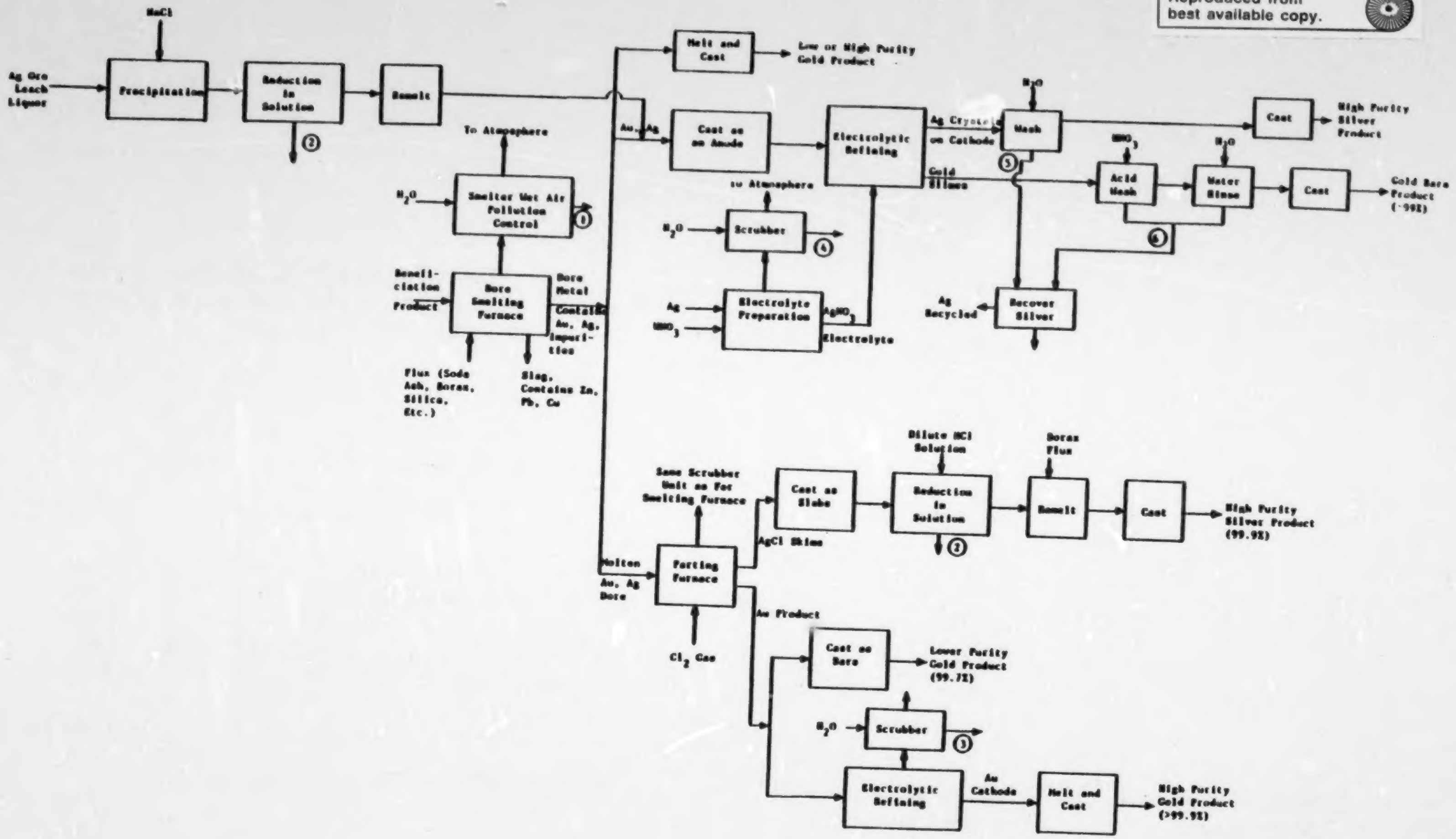
Ag Ore Leach Liquor
NaCl
Precipitation
Reduction in Solution
②
Remelt
Melt and Cast
Low or High Purity Gold Product
Au, Ag
Cast as an Anode
Electrolytic Refining
Ag Crystals on Cathode
Gold Slimes
H2O
Wash
⑤
Cast
High Purity Silver Product
HNO3
Acid Wash
H2O
Water Rinse
Cast
Gold Bars Product (~99%)
⑥
Ag Recycled
Recover Silver
To Atmosphere
H2O
Smelter Wet Air Pollution Control
①
Benefi- ciation Product
Dore Smelting Furnace
Dore Metal Contains Au, Ag, Impuri- ties
Flux (Soda Ash, Borax, Silica, Etc.)
Slag, Contains Zn, Pb, Cu
To Atmosphere
H2O
Scrubber
④
Ag
HNO3
Electrolyte Preparation
AgNO3
Electrolyte
Same Scrubber Unit as For Smelting Furnace
Molten Au, Ag Dore
Parting Furnace
Cl2 Gas
AgCl Skims
Cast as Slabs
Dilute HCl Solution
Reduction in Solution
②
Borax Flux
Remelt
Cast
High Purity Silver Product (99.9%)
Au Product
Cast as Bars
Lower Purity Gold Product (99.7%)
H2O
Scrubber
③
Electrolytic Refining
Au Cathode
Melt and Cast
High Purity Gold Product (>99.9%)

Figure III-1

PRIMARY PRECIOUS METALS PRODUCTION PROCESSES

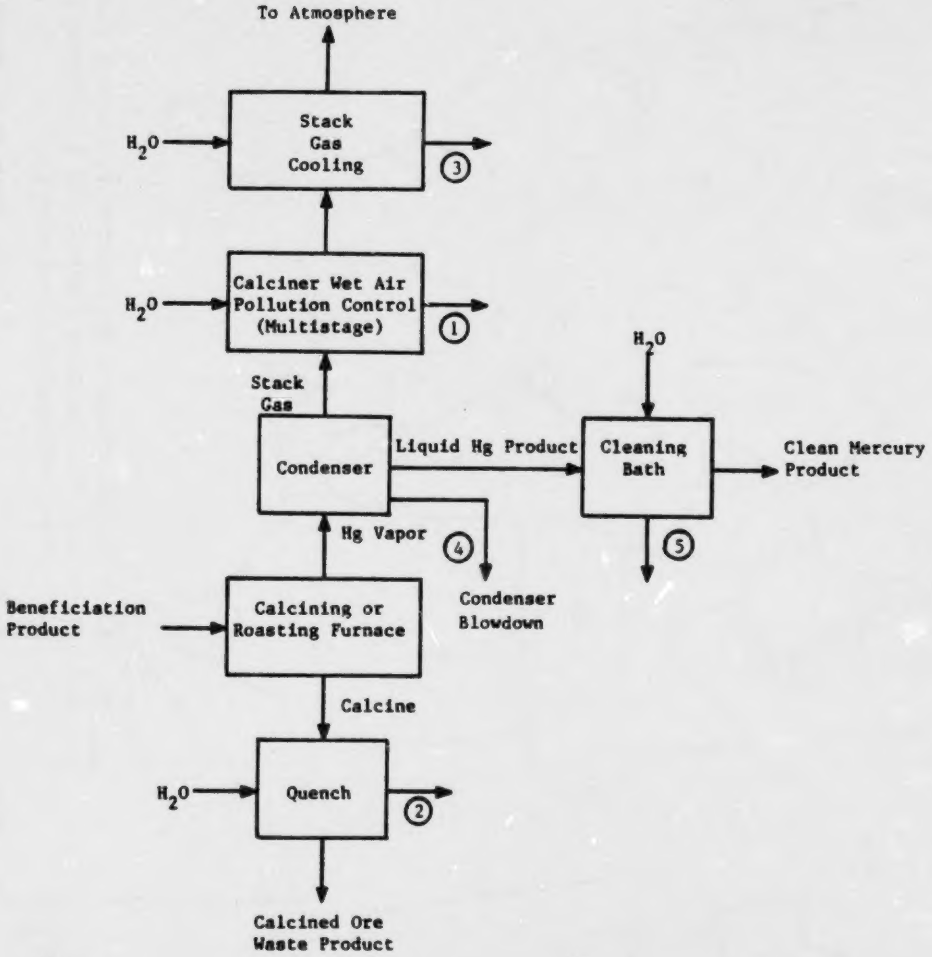
To Atmosphere
H_2O
Stack Gas Cooling
3
H_2O
Calciner Wet Air Pollution Control (Multistage)
1
Stack Gas
H_2O
Condenser
Liquid Hg Product
Cleaning Bath
Clean Mercury Product
5
Hg Vapor
4
Condenser Blowdown
Beneficiation Product
Calcining or Roasting Furnace
Calcine
H_2O
Quench
2
Calcined Ore Waste Product

Figure III-2

PRIMARY MERCURY PRODUCTION PROCESS

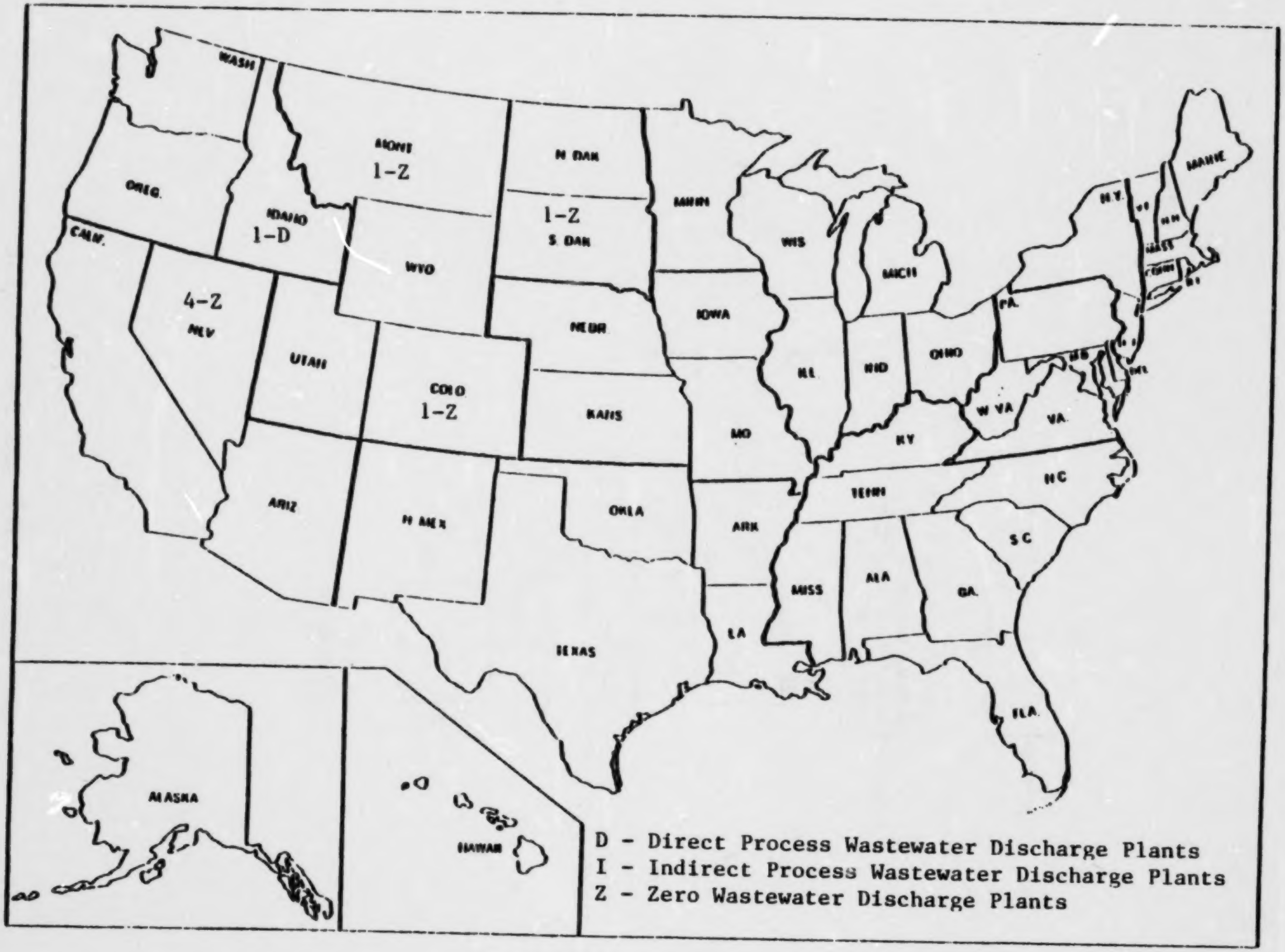
WASH
OREG.
CALIF.
IDAHO
1-D
MONT
1-Z
WYO
NEV
4-Z
UTAH
COLO
1-Z
ARIZ
N MEX
N DAK
S DAK
1-Z
NEBR
KANS
OKLA
TEXAS
MINN
IOWA
MO
ARK
LA
WIS
ILL
MICH
IND
OHIO
KY
TENN
MISS
ALA
GA.
FLA.
SC
NC
VA.
W VA
PA.
NY
VT
NH
MAINE
MASS
CONN
RI
MD
DEL
ALASKA
HAWAII
D - Direct Process Wastewater Discharge Plants
I - Indirect Process Wastewater Discharge Plants
Z - Zero Wastewater Discharge Plants

Figure III-3

GEOGRAPHIC LOCATIONS OF THE PRIMARY PRECIOUS METALS AND MERCURY SUBCATEGORY PLANTS

SECTION IV

SUBCATEGORIZATION

This section summarizes the factors considered during the designation of the primary precious metals and mercury subcategory and its related subdivisions. Production normalizing parameters for each subdivision are also discussed.

FACTORS CONSIDERED IN SUBDIVIDING THE PRIMARY PRECIOUS METALS AND MERCURY SUBCATEGORY

The factors listed for general subcategorization were each evaluated when considering subdivision of the primary precious metals and mercury subcategory. In the discussion that follows, the factors will be described as they pertain to this particular subcategory.

The rationale for considering segmentation of the primary precious metals and mercury subcategory is based primarily on differences in the production processes and raw materials used. Within this subcategory, a number of different operations are performed, which may or may not have a water use or discharge, and which may require the establishment of separate effluent limitations. While primary precious metals and mercury is considered a single subcategory, a more thorough examination of the production processes has illustrated the need for limitations and standards based on a specific set of waste streams. Limitations will be based on specific flow allowances for the following subdivisions or building blocks.

1. Smelter wet air pollution control,
2. Silver chloride reduction spent solution,
3. Electrolytic cells wet air pollution control,
4. Electrolyte preparation wet air pollution control,
5. Calciner wet air pollution control,
6. Calcine quench water,
7. Calciner stack gas contact cooling water,
8. Condenser blowdown, and
9. Mercury cleaning bath water.

These building blocks follow directly from differences within the three distinct production stages of primary precious metals and mercury.

The smelting of precious metals bearing concentrates to produce Dore metals gives rise to the first subdivision: smelter wet air pollution control wastewater. If any remelt furnaces are used in the process, the resulting off-gases are usually combined with smelter off-gases for air pollution control. Thus, the smelter wet air pollution control subdivision represents the wet air pollution control wastewater for both smelters and remelt furnaces. The next two subdivisions result from either the Miller process for purifying high silver content Dore metal or the recovery of silver from Ag-Cu ore by silver precipitation. The electrolytic cells scrubber wastewater from gold refining is a principal waste stream, and spent solution from silver reduction is another significant waste stream.

The electrolytic refining of silver from Dore metal gives rise to the next subdivision. The fourth subdivision is created by the wet scrubber used to control air emissions from the electrolyte preparation stage.

The last five subdivisions result from the production of primary mercury. The treatment of calciner off-gases by wet scrubbing gives rise to the first of these subdivisions. Waste streams may also result from the quenching of calciner wastes to reduce their temperature prior to disposal and the cooling of calciner off-gases before discharge from the stack. During condensation of the vaporized mercury, the condensation of a water fraction can occur and this condenser blowdown is a possible waste stream. After condensation the liquid mercury may be further purified by use of cleaning baths. This cleaning operation is also a potential source of wastewater.

OTHER FACTORS

The other factors considered in this evaluation were shown to be inappropriate as a bases for further segmentation. Air pollution control methods, treatment costs, and total energy requirements are functions of the selected subcategorization factors--metal product, raw materials, and production processes. Therefore, they are not independent factors and do not affect the subcategorization which has been developed. As discussed in Section IV of the General Development Document, certain other factors, such as plant age, plant size, and the number of employees, were also evaluated and determined to be inappropriate for use as bases for subdivision of nonferrous metals plants.

PRODUCTION NORMALIZING PARAMETERS

As discussed previously, the effluent limitations and standards developed in this document establish mass limitations for the discharge of specific pollutant parameters. To allow these regulations to be applied to plants with various production capacities, the mass of pollutant discharged must be related to a unit of production. This factor is known as the production normalizing parameter (PNP).

In general, for each production process which has a wastewater associated with it, the actual mass of precious metal or mercury product produced will be used as the PNP. Thus, the PNPs for the nine subdivisions are as follows:

Building Block	PNP
1. Smelter wet air pollution control	troy ounce of gold and silver smelted
2. Silver chloride reduction spent solution	troy ounce of silver reduced in solution
3. Electrolytic cells wet air pollution control	troy ounce of gold refined electrolytically
4. Electrolyte preparation wet air pollution control	troy ounce of silver in electrolyte produced
5. Calciner wet air pollution control	kkg of mercury condensed
6. Calcine quench water	kkg of mercury condensed
7. Calciner stack gas contact cooling water	kkg of mercury condensed
8. Condenser blowdown	kkg of mercury condensed
9. Mercury cleaning bath water	kkg of mercury condensed

Other PNPs were considered. The use of production capacity instead of actual production was eliminated from consideration because the wastewater generated and the mass of the pollutant produced is more a function of true production than of installed capacity. The use of some common intermediate (i.e., gold and silver cathodes or silver chloride) as a basis for PNPs for all processes was rejected since not all plants follow the same production path to get to the specific end-product. Additionally, some plants divert part of their intermediate products and sell them instead of processing all input raw materials to one final product. If an "end-product" were chosen as the PNP, plants that had these upstream diversions would be allowed to discharge more per mass of product than their competitors who did not.

SECTION V

WATER USE AND WASTEWATER CHARACTERISTICS

This section describes the characteristics of the wastewaters associated with the primary precious metals and mercury subcategory. Water use and discharge rates are explained and then summarized in tables at the end of this section. Data used to characterize the wastewaters are presented. Finally, the specific source, water use and discharge flows, and wastewater characteristics for each separate wastewater source are discussed.

Two principal data sources were used in the development of effluent limitations and standards for this subcategory: data collection portfolios (dcp) and field sampling results. Data collection portfolios contain information regarding wastewater flows and production levels.

In order to quantify the pollutant discharge from primary precious metals and mercury plants, a field sampling program was conducted. A complete list of the pollutants considered and a summary of the techniques used in sampling and laboratory analyses are included in Section V of Vol. I. Samples were analyzed for 124 of the 126 priority pollutants and other pollutants deemed appropriate. Because the analytical standard for TCDD was judged to be too hazardous to be made generally available, samples were never analyzed for this pollutant. Samples were also not analyzed for asbestos. There is no reason to expect that TCDD or asbestos would be present in nonferrous metals manufacturing wastewater. Two plants were selected for sampling in the primary precious metals and mercury subcategory. In general, the samples were analyzed for three classes of pollutants: priority organic pollutants, priority metal pollutants, and criteria pollutants (which includes both conventional and nonconventional pollutants).

After proposal, EPA gathered additional wastewater sampling data for two of the subdivisions in this subcategory. These data were acquired through a self-sampling program and include data from analyses for the priority metals arsenic, cadmium, chromium, copper, lead, mercury, nickel, silver, thallium, and zinc. These data also include analyses for the nonconventional pollutant gold. These data show pollutant concentrations similar to those indicated by the data which EPA had acquired for these subdivisions prior to proposal. These data also support the assumptions which EPA had made concerning the presence and concentrations of pollutants in those subdivisions where we did not have analytical data for specific pollutants. For this reason, the selection of pollutant parameters for limitation in this subcategory (Section VI) has not been revised based on these new data.

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As described in Section IV of this supplement, the primary precious metals and mercury subcategory has been divided into nine subdivisions or wastewater sources, so that the promulgated regulation contains mass discharge limitations and standards for nine unit processes discharging process wastewater. Differences in the wastewater characteristics associated with these subdivisions are to be expected. For this reason, wastewater streams corresponding to each subdivision are addressed separately in the discussions that follow. These wastewater sources are:

1. Smelter wet air pollution control,
2. Silver chloride reduction spent solution,
3. Electrolytic cells wet air pollution control,
4. Electrolyte preparation wet air pollution control,
5. Calciner wet air pollution control,
6. Calcine quench water,
7. Calciner stack gas contact cooling water,
8. Condenser blowdown, and
9. Mercury cleaning bath water.

WASTEWATER FLOW RATES

Data supplied by dcp responses were evaluated, and two flow-to-production ratios, water use and wastewater discharge flow, were calculated for each stream. The two ratios are differentiated by the flow value used in calculation. Water use is defined as the volume of water or other fluid required for a given process per mass of product and is therefore based on the sum of recycle and make-up flows to a given process. Wastewater flow discharged after pretreatment or recycle (if these are present) is used in calculating the production normalized flow--the volume of wastewater discharged from a given process to further treatment, disposal, or discharge per mass of product produced. Differences between the water use and wastewater flows associated with a given stream result from recycle, evaporation, and carry-over on the product. The production values used in calculation correspond to the production normalizing parameter, PNP, assigned to each stream, as outlined in Section IV. As an example, calcine quench water flow is related to the production of refined mercury. As such, the discharge rate is expressed in liters of quench water per metric ton of mercury produced (gallons of quench water per ton of mercury).

The production normalized discharge flows were compiled and statistically analyzed by stream type. These production normalized water use and discharge flows are presented by subdivision in Tables V-1 through V-9 (pages 2189 - 2192) at the end of this section. Where appropriate, an attempt was made to identify factors that could account for variations in water use and discharge rates. These variations are discussed later in this section by subdivision. A similar analysis of factors affecting the wastewater flows is presented in Sections X, XI, and XII where representative BAT, NSPS, and pretreatment flows are selected for use in calculating the effluent limitations.

The water use and discharge rates shown do not include nonprocess wastewater, such as rainfall runoff and noncontact cooling water.

Data used to characterize the various wastewaters associated with primary precious metals and mercury production come from two sources--data collection portfolios and analytical data from field sampling trips.

DATA COLLECTION PORTFOLIOS

In the data collection portfolios, the primary precious metals and mercury plants that generate wastewater were asked to specify the presence or absence of priority pollutants in their wastewater. In most cases, the plants indicated that the priority organic pollutants were believed to be absent. However, two of the plants stated that they either knew or believed priority metals to be present. The responses for asbestos, cyanide, and the priority metals are summarized below:*

Pollutant	Known Present	Believed Present
Antimony	0	0
Arsenic	1	0
Asbestos	0	1
Beryllium	0	0
Cadmium	1	0
Chromium	1	0
Copper	1	0
Cyanide	1	0
Lead	1	0
Mercury	2	1
Nickel	1	0
Selenium	1	0
Silver	1	0
Thallium	0	0
Zinc	1	0

*Six plants which produce primary precious metals and mercury have been omitted due to lack of data.

Although asbestos was reported as believed present by one plant, the trip report from this facility stated it was the mineral cummingtonite which was present and not asbestos. While the two minerals have some similarities such as similar chemical formulas, cummingtonite is not listed by EPA as a priority pollutant.

FIELD SAMPLING DATA

In order to quantify the concentrations of pollutants present in wastewater from primary precious metals and mercury plants, wastewater samples were collected at two plants. The analytical results from one of these two plants are not presented here because they are claimed to be confidential by the plant. A diagram indicating the sampling sites and contributing production processes at the non-confidential plant is shown in Figure V-1 (page 2208).

Raw wastewater data are summarized in Tables V-10 through V-13 (pages 2193 - 2205). Analytical results for the combined stream of smelter scrubber water and Miller electrolysis cell scrubber water as well as spent solution from silver reduction are classified as confidential. Table V-10 presents data for each of the three stages of the calciner scrubber system. Tables V-11, V-12, and V-13 present sampling data for calcine quench water, calciner stack gas cooling water, and mercury cleaning bath water, respectively. Note that the stream numbers listed in the tables correspond to those given in the individual plant sampling site diagram, Figure V-1. Where no data are listed for a specific day of sampling, the wastewater samples for the stream were not collected.

Several points regarding these tables should be noted. The data tables include some samples measured at concentrations considered not quantifiable. The base-neutral extractable, acid extractable, and volatile organics generally are considered not quantifiable at concentrations equal to or less than 0.010 mg/l. Below this concentration, organic analytical results are not quantitatively accurate; however, the analyses are useful to indicate the presence of a particular pollutant. The pesticide fraction is considered not quantifiable at concentrations equal to or less than 0.005 mg/l.

The detection limits shown on the data tables for toxic metals and conventional and nonconventional pollutants are not the same in all cases as the published detection limits for these pollutants by the same analytical methods. The detection limits used were reported with the analytical data and hence are the appropriate limits to apply to the data. Detection limit variation can occur as a result of a number of laboratory-specific, equipment-specific, and daily operator-specific factors. These factors can include day-to-day differences in machine calibration, variation in stock solutions, and variation in operators.

The statistical analysis of data includes some samples measured at concentrations considered not quantifiable. For data considered as detected but below quantifiable concentrations, a value of zero is used for averaging. Priority organic, nonconventional, and conventional pollutant data reported with a "less than" sign are considered as detected, but not further quantifiable. A value of zero is also used for averaging. If a pollutant is reported as not detected, it is assigned a value of zero in calculating the average. Toxic metal values reported as less than a certain value were considered as below quantification, and consequently were assigned a value of zero in the calculation of the average.

Finally, appropriate source water concentrations are presented with the summaries of the sampling data. The method by which each sample was collected is indicated by number, as follows:

1 One-time grab
2 Manual composite during intermittent process operation
3 8-hour manual composite
4 8-hour automatic composite
5 24-hour manual composite
6 24-hour automatic composite

WASTEWATER CHARACTERISTICS AND FLOWS BY SUBDIVISION

Since primary precious metals and mercury production involves nine principal sources of wastewater and each has potentially different characteristics and flows, the wastewater characteristics and discharge rates corresponding to each subdivision will be described separately. A brief description of why the associated production processes generate a wastewater and explanations for variations of water use within each subdivision will also be discussed.

Two subdivisions, gold slimes acid wash and water rinse, and silver crystals wash water have been deleted following proposal. These subdivisions have been deleted based on information obtained as a result of a post-proposal request for data. The one facility which was believed to discharge these streams reported that this water is totally reused in other plant processes.

SMELTER WET AIR POLLUTION CONTROL

Six of the eight plants in this subcategory smelt or roast the precious metal-bearing raw material. Only three of those facilities, however, use a wet air pollution control device to control air emissions from the furnace. Two of these devices are scrubbers, while one (at plant 1003) is an electrostatic precipitator (ESP). Two plants practice dry air pollution control, and one plant does not practice any air pollution control. The production normalized water use and discharge rates are presented in Table V-1 (page 2189) in liters per troy ounce of gold and silver smelted.

Analytical data for the combined smelter wet air pollution control and electrolytic cells wet air pollution control waste streams are contained in the confidential record. The data show that this wastewater contains treatable concentrations of toxic metals, suspended solids, and oil and grease.

SILVER CHLORIDE REDUCTION SPENT SOLUTION

Silver metal is produced from silver chloride by a dissolution and cementation process. The silver chloride is dissolved in water and recovered by cementation. The silver is replaced in solution, causing the silver ions to be reduced and precipitated from solution as silver metal. The resulting solution is a wastewater stream. The silver chloride used as a feed material to this process may be a product of the Miller process or silver chloride precipitated from a silver ore leaching solution. The production normalized water use and discharge flows are presented in Table V-2 (page 2189), in liters per troy ounce of silver reduced in solution.

One plant supplied information in a telephone conversation with EPA concerning a post-proposal plant self-sampling effort which included revised process information. This information shows that the plant recovers silver metal from silver ore using a reduction of silver chloride process. This plant generates a spent solution from this process which it discharges. No flow information was reported for this stream, during the telephone conversation. In the self-sampling effort, information supplied by the facility corroborates the flow selected for BAT for this stream (see Section X), although this was not quantified precisely enough to be used to revise the BAT flow.

Following proposal, sampling data for spent silver chloride reduction solution were acquired at the specific request of EPA through a self-sampling effort. These self sampling data are presented in Table V-14 (page 2208) and show treatable concentrations of antimony, arsenic, cadmium, chromium, copper, lead, nickel, silver, and zinc, thus corroborating the data used at proposal.

ELECTROLYTIC CELLS WET AIR POLLUTION CONTROL

The use of wet scrubbers to control emissions from electrolytic cells is practiced at only one plant in this subcategory. Production normalized water use and discharge rates are presented in Table V-3 (page 2190). Sampling data for the combined smelter wet air pollution control and electrolytic cell wet air pollution control waste stream are contained in the confidential record. The data show this waste stream to contain treatable concentrations of toxic metals, suspended solids, and oil and grease.

ELECTROLYTE PREPARATION WET AIR POLLUTION CONTROL

The silver nitrate electrolyte used in the electrolytic in refining of Dore metal is prepared by dissolving pure silver nitric acid. The facility that uses this process also uses a wet scrubber to control air emissions from the preparation step, thereby generating a waste stream. Production normalized water use and discharge rates are presented in Table V-4 (page 2190) in liters per troy ounce of silver in electrolyte produced. No sampling data were gathered for this waste stream prior to proposal; however, it was expected to have characteristics similar to those of the combined raw wastewaters from smelter wet air pollution control and the electrolytic cell scrubber. This waste stream, therefore, was expected to contain treatable concentrations of suspended solids, toxic metals, and oil and grease.

Following proposal, sampling data for this subdivision were acquired at the specific request of EPA through a self-sampling effort. These data are presented in Table V-14 and show a pH of 1.23 and treatable concentrations of arsenic, cadmium, chromium, copper, lead, mercury, nickel, silver, and zinc, thus corroborating the data used at proposal.

CALCINER WET AIR POLLUTION CONTROL

One of the two plants producing primary mercury uses a water scrubber to control air emissions from the calciner. This plant uses a series of three scrubbers (Venturi, impinger, and SO_2). Sampling data for the wastewater generated by these scrubbers are presented in Table V-10 (page 2202). The scrubber waters have a low pH (2.3 to 2.6) and contain treatable concentrations of priority metals such as lead, mercury, thallium and zinc, and suspended solids. The production normalized water use and discharge rates are shown in Table V-5 (page 2192).

CALCINE QUENCH WATER

One mercury producer uses water to quench the waste calcines from the mercury roaster to allow faster handling and disposal of these materials. Table V-6 (page 2192) presents the production normalized water use and discharge rates for this waste stream. Sampling data are summarized in Table V-11 (page 2205) and show high concentrations of priority metals such as arsenic, mercury and zinc, and suspended solids. This waste stream has a nearly neutral pH of 6.8.

CALCINER STACK GAS CONTACT COOLING WATER

One facility uses contact cooling water to reduce the temperature of the calciner off-gases before releasing them to the atmosphere. Sampling data for this waste stream are summarized in Table V-12 (page 2209). This waste stream has a pH of 2.5 and contains treatable concentrations of mercury and suspended solids. Production normalized water use and discharge rates are given in Table V-7 (page 2192).

CONDENSER BLOWDOWN

When mercury is vaporized in the calciner, some water contained in the Cinnabar or gold ore may also be vaporized. The condensation of mercury for recovery may result in the condensation of some water which is discharged as condenser blowdown. Table V-8 (page 2193) summarizes the production normalized water use and discharge rates for this waste stream.

Although no sampling data were collected for this waste stream, it is expected to be very similar to the discharge from the mercury cleaning bath. The condenser blowdown stream is expected to contain treatable concentrations of mercury and suspended solids.

MERCURY CLEANING BATH WATER

Condensed mercury is processed for the removal of impurities by being passed through a water cleaning bath. This waste stream contains treatable concentrations of mercury and suspended solids and very low concentrations of other toxic metals. The sampling data for this wastewater stream are presented in Table V-13 (page 2205). Production normalized water use and discharge rates are provided in Table V-9 (page 2199).

TABLE V-1

WATER USE AND DISCHARGE RATES FOR SMELTER WET AIR POLLUTION CONTROL

(l/troy ounce of gold and silver smelted)

Plant Code	Percent Recycle	Production Normalized Water Use	Production Normalized Discharge Flow
1131*	76	25.8	6.2
1003	90	5.3	0.53
1137	100	8.41	0
1068	Dry		
1158	Dry		

*No operations conducted in 1982: water use and discharge rates based on projected 1983 figures.

TABLE V-2

WATER USE AND DISCHARGE RATES FOR SILVER CHLORIDE REDUCTION SPENT SOLUTION

(l/troy ounce of silver reduced in solution)

Plant Code	Percent Recycle	Production Normalized Water Use	Production Normalized Discharge Flow
1003	0	0.4	0.4
1160	0	NR	NR

NR - Data not reported.

TABLE V-3

WATER USE AND DISCHARGE RATES FOR ELECTROLYTIC CELLS WET AIR POLLUTION CONTROL

(l/troy ounce of gold refined electrolytically)

Plant Code	Percent Recycle	Production Normalized Water Use	Production Normalized Discharge Flow
1003	0	198	19

TABLE V-4

WATER USE AND DISCHARGE RATES FOR ELECTROLYTE PREPARATION WET AIR POLLUTION CONTROL

(l/troy ounce of silver in electrolyte produced)

Plant Code	Percent Recycle	Production Normalized Water Use	Production Normalized Discharge Flow
1160	0	0.05	0.05

TABLE V-5

WATER USE AND DISCHARGE RATES FOR CALCINER WET AIR POLLUTION CONTROL

(1/kkg of mercury condensed)

Plant Code	Percent Recycle	Production Normalized Water Use	Production Normalized Discharge Flow
1124 (Venturi)	16	4,607	3,870
1124 (Impinger)	16	7,536	6,330
1124 (SO_2)	16	209,524	176,000
TOTAL	16	221,667	186,200

TABLE V-6

WATER USE AND DISCHARGE RATES FOR CALCINE QUENCH WATER

(1/kkg of mercury condensed)

Plant Code	Percent Recycle	Production Normalized Water Use	Production Normalized Discharge Flow
1124	0	17,600	17,600

TABLE V-7

WATER USE AND DISCHARGE RATES FOR CALCINER STACK GAS CONTACT COOLING WATER

(l/kkg of mercury condensed)

Plant Code	Percent Recycle	Production Normalized Water Use	Production Normalized Discharge Flow
1124	0	4,150	4,150

TABLE V-8

WATER USE AND DISCHARGE RATES FOR CONDENSER BLOWDOWN

(l/kkg of mercury condensed)

Plant Code	Percent Recycle	Production Normalized Water Use	Production Normalized Discharge Flow
1068	0	13,800	13,800
1124	Dry		

TABLE V-9

WATER USE AND DISCHARGE RATES FOR MERCURY CLEANING BATH WATER

(l/kkg of mercury condensed)

Plant Code	Percent Recycle	Production Normalized Water Use	Production Normalized Discharge Flow
1124	0	1,400	1,400

Table V-10

PRIMARY PRECIOUS METALS AND MERCURY SUBCATEGORY SAMPLING DATA
CALCINER WET AIR POLLUTION CONTROL
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l)			
			Source	Day 1	Day 2	Day 3
Toxic Pollutants						
114. antimony	40	1	<0.003	<0.003		
	41	1	<0.003	<0.003		
	42	1	<0.003	<0.003		
115. arsenic	40	1	0.013	0.32		
	41	1	0.013	0.059		
	42	1	0.013	0.013		
117. beryllium	40	1	<0.01	<0.01		
	41	1	<0.01	<0.01		
	42	1	<0.01	<0.01		
118. cadmium	40	1	<0.01	0.04		
	41	1	<0.01	<0.02		
	42	1	<0.01	<0.01		
119. chromium (total)	40	1	<0.02	<0.02		
	41	1	<0.02	<0.02		
	42	1	<0.02	<0.02		
120. copper	40	1	0.31	<0.01		
	41	1	0.31	<0.01		
	42	1	0.31	<0.01		

Table V-10 (Continued)

PRIMARY PRECIOUS METALS AND MERCURY SUBCATEGORY SAMPLING DATA
CALCINER WET AIR POLLUTION CONTROL
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
122. lead	40	1	<0.002	2.2		
	41	1	<0.002	<0.002		
	42	1	<0.002	<0.002		
123. mercury	40	1	0.016	360		
	41	1	0.016	130		
	42	1	0.016	0.84		
124. nickel	40	1	<0.05	<0.05		
	41	1	<0.05	<0.05		
	42	1	<0.05	<0.05		
125. selenium	40	1	<0.003	<0.003		
	41	1	<0.003	<0.003		
	42	1	<0.003	<0.003		
126. silver	40	1	<0.001	<0.001		
	41	1	<0.001	<0.001		
	42	1	<0.001	<0.001		
127. thallium	40	1	<0.002	0.61		
	41	1	<0.002	0.12		
	42	1	<0.002	<0.002		
128. zinc	40	1	<0.01	0.73		
	41	1	<0.01	<0.01		
	42	1	<0.01	<0.01		

Table V-10 (Continued)

PRIMARY PRECIOUS METALS AND MERCURY SUBCATEGORY SAMPLING DATA
CALCINER WET AIR POLLUTION CONTROL
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Nonconventional Pollutants						
acidity	40	1	<1	490		
	41	1	<1	490		
	42	1	<1	1,430		
alkalinity	40	1	190	<1		
	41	1	190	<1		
	42	1	190	<1		
aluminum	40	1	<0.05	<0.05		
	41	1	<0.05	<0.05		
	42	1	<0.05	<0.05		
barium	40	1	0.05	0.018		
	41	1	0.05	0.021		
	42	1	0.05	0.053		
boron	40	1	0.041	<0.009		
	41	1	0.041	<0.009		
	42	1	0.041	0.027		
calcium	40	1	52	52		
	41	1	52	53		
	42	1	52	51		
chloride	40	1	50	270		
	41	1	50	75		
	42	1	50	91		

Table V-10 (Continued)

PRIMARY PRECIOUS METALS AND MERCURY SUBCATEGORY SAMPLING DATA
CALCINER WET AIR POLLUTION CONTROL
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Nonconventional Pollutants (Continued)						
cobalt	40	1	<0.006	<0.006		
	41	1	<0.006	<0.006		
	42	1	<0.006	<0.006		
fluoride	40	1	1.1	0.77		
	41	1	1.1	0.84		
	42	1	1.1	1.1		
iron	40	1	0.05	1.0		
	41	1	0.05	0.24		
	42	1	0.05	<0.02		
magnesium	40	1	8.0	7.7		
	41	1	8.0	8.0		
	42	1	8.0	8.0		
manganese	40	1	<0.01	<0.01		
	41	1	<0.01	<0.01		
	42	1	<0.01	<0.01		
molybdenum	40	1	<0.002	<0.002		
	41	1	<0.002	<0.002		
	42	1	<0.002	<0.002		
sodium	40	1	53	83		
	41	1	53	60		
	42	1	53	52		

Table V-10 (Continued)

PRIMARY PRECIOUS METALS AND MERCURY SUBCATEGORY SAMPLING DATA
CALCINER WET AIR POLLUTION CONTROL
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Nonconventional Pollutants (Continued)						
sulfate	40	1	150	67,000		
	41	1	150	68,000		
	42	1	150	17,000		
tin	40	1	<0.12	<0.12		
	41	1	<0.12	<0.12		
	42	1	<0.12	<0.12		
titanium	40	1	<0.005	<0.005		
	41	1	<0.005	<0.005		
	42	1	<0.005	<0.005		
total solids (TS)	40	1	670	1,300		
	41	1	670	800		
	42	1	670	700		
vanadium	40	1	<0.003	<0.003		
	41	1	<0.003	<0.003		
	42	1	<0.003	<0.003		
yttrium	40	1	<0.002	<0.002		
	41	1	<0.002	<0.002		
	42	1	<0.002	<0.002		

Table V-10 (Continued)

PRIMARY PRECIOUS METALS AND MERCURY SUBCATEGORY SAMPLING DATA
CALCINER WET AIR POLLUTION CONTROL
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Conventional Pollutants						
oil and grease	40	1	<1	<1		
	41	1	<1	<1		
	42	1	<1	<1		
total suspended solids (TSS)	40	1	<1	80		
	41	1	<1	5		
	42	1	<1	<1		
pH (standard units)	40	1	6.9	2.3		
	41	1	6.9	2.3		
	42	1	6.9	2.6		

†Sample Type Code: 1 - One time grab

Table V-11

PRIMARY PRECIOUS METALS AND MERCURY SUBCATEGORY SAMPLING DATA
CALCINE QUENCH WATER
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l)			
			Source	Day 1	Day 2	Day 3
Toxic Pollutants						
114. antimony	45	1	<0.003	<0.007		
115. arsenic	45	1	0.013	17		
117. beryllium	45	1	<0.01	<0.01		
118. cadmium	45	1	<0.01	0.06		
119. chromium (total)	45	1	<0.02	0.09		
120. copper	45	1	0.31	0.30		
122. lead	45	1	<0.002	0.38		
123. mercury	45	1	0.016	1.4		
124. nickel	45	1	<0.05	<0.05		
125. selenium	45	1	<0.003	<0.003		
126. silver	45	1	<0.001	0.13		
127. thallium	45	1	<0.002	0.19		
128. zinc	45	1	<0.001	1.7		

Table V-11 (Continued)

PRIMARY PRECIOUS METALS AND MERCURY SUBCATEGORY SAMPLING DATA
CALCINE QUENCH WATER
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Nonconventional Pollutants						
acidity	45	1	<1	<1		
alkalinity	45	1	190	48		
aluminum	45	1	<0.50	52		
barium	45	1	0.05	1.6		
boron	45	1	0.041	1.3		
calcium	45	1	52	1,800		
chloride	45	1	50	930		
cobalt	45	1	<0.006	0.044		
fluoride	45	1	1.1	5.6		
iron	45	1	0.05	150		
magnesium	45	1	8.0	21		
manganese	45	1	<0.01	0.75		
molybdenum	45	1	<0.002	0.66		

Table V-11 (Continued)

PRIMARY PRECIOUS METALS AND MERCURY SUBCATEGORY SAMPLING DATA
CALCINE QUENCH WATER
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l)			
			Source	Day 1	Day 2	Day 3
Nonconventional Pollutants (Continued)						
sodium	45	1	53	2,600		
sulfate	45	1	150	1,900		
tin	45	1	<0.12	<0.12		
titanium	45	1	<0.005	12		
total solids (TS)	45	1	670	13,000		
vanadium	45	1	<0.003	0.55		
yttrium	45	1	<0.002	0.14		
Conventional Pollutants						
oil and grease	45	1	<1	<1		
total suspended solids	45	1	<1	3,700		
pH (standard units)	45	1	6.9	6.8		

†Sample Type Code: 1 - One-time grab

Table V-12

PRIMARY PRECIOUS METALS AND MERCURY SUBCATEGORY SAMPLING DATA
CALCINER STACK GAS CONTACT COOLING WATER
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants						
114. antimony	43	1	<0.003	<0.003		
115. arsenic	43	1	0.013	0.017		
117. beryllium	43	1	<0.01	<0.01		
118. cadmium	43	1	<0.01	<0.01		
119. chromium (total)	43	1	<0.02	<0.02		
120. copper	43	1	0.31	<0.01		
122. lead	43	1	<0.002	<0.002		
123. mercury	43	1	0.016	2.1		
124. nickel	43	1	<0.05	<0.05		
125. selenium	43	1	<0.003	<0.003		
126. silver	43	1	<0.001	<0.001		
127. thallium	43	1	<0.002	0.004		
128. zinc	43	1	<0.01	<0.02		

Table V-12 (Continued)

PRIMARY PRECIOUS METALS AND MERCURY SUBCATEGORY SAMPLING DATA
CALCINER STACK GAS CONTACT COOLING WATER
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Nonconventional Pollutants						
acidity	43	1	<1	1,800		
alkalinity	43	1	190	<1		
aluminum	43	1	<0.50	<0.50		
barium	43	1	0.050	0.047		
boron	43	1	0.041	<0.009		
calcium	43	1	52	52		
chloride	43	1	50	53		
cobalt	43	1	<0.006	<0.006		
fluoride	43	1	1.1	1.1		
iron	43	1	0.05	0.039		
magnesium	43	1	8.0	8.0		
manganese	43	1	<0.01	<0.01		
molybdenum	43	1	<0.002	<0.002		

Table V-12 (Continued)

PRIMARY PRECIOUS METALS AND MERCURY SUBCATEGORY SAMPLING DATA
CALCINER STACK GAS CONTACT COOLING WATER
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l)			
			Source	Day 1	Day 2	Day 3
Nonconventional Pollutants (Continued)						
sodium	43	1	53	53		
sulfate	43	1	150	23,600		
tin	43	1	<0.12	<0.12		
titanium	43	1	<0.005	<0.005		
total solids (TS)	43	1	670	880		
vanadium	43	1	<0.003	<0.003		
yttrium	43	1	<0.002	<0.002		
Conventional Pollutants						
oil and grease	43	1	<1	<1		
total suspended solids	43	1	<1	4		
pH (standard units)	43	1	6.9	2.5		

†Sample Type Code: 1 - One-time grab

Table V-13

PRIMARY PRECIOUS METALS AND MERCURY SUBCATEGORY SAMPLING DATA
MERCURY CLEANING BATH WATER
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants						
114. antimony	44	1	<0.003	<0.003		
115. arsenic	44	1	0.013	0.017		
117. beryllium	44	1	<0.01	<0.01		
118. cadmium	44	1	<0.01	<0.01		
119. chromium (total)	44	1	<0.02	<0.01		
120. copper	44	1	0.31	<0.01		
122. lead	44	1	<0.002	<0.002		
123. mercury	44	1	0.016	2.5		
124. nickel	44	1	<0.05	<0.05		
125. selenium	44	1	<0.003	<0.003		
126. silver	44	1	<0.001	<0.001		
127. thallium	44	1	<0.002	<0.002		
128. zinc	44	1	<0.01	<0.01		

Table V-13 (Continued)

PRIMARY PRECIOUS METALS AND MERCURY SUBCATEGORY SAMPLING DATA
MERCURY CLEANING BATH WATER
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Nonconventional Pollutants						
acidity	44	1	<1	1,700		
alkalinity	44	1	190	170		
aluminum	44	1	<0.5	<0.5		
barium	44	1	0.050	0.059		
boron	44	1	0.041	0.022		
calcium	44	1	52	52		
chloride	44	1	50	47		
cobalt	44	1	<0.006	<0.006		
fluoride	44	1	1.1	0.96		
iron	44	1	0.05	<0.02		
magnesium	44	1	8.0	7.9		
manganese	44	1	<0.01	<0.01		
molybdenum	44	1	<0.002	<0.002		

Table V-13 (Continued)

PRIMARY PRECIOUS METALS AND MERCURY SUBCATEGORY SAMPLING DATA
MERCURY CLEANING BATH WATER
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l)			
			Source	Day 1	Day 2	Day 3
Nonconventional Pollutants (Continued)						
sodium	44	1	53	53		
sulfate	44	1	150	74		
tin	44	1	<0.12	<0.12		
titanium	44	1	<0.005	<0.005		
total solids (TS)	44	1	670	690		
vanadium	44	1	<0.003	<0.003		
yttrium	44	1	<0.002	<0.002		
Conventional Pollutants						
oil and grease	44	1	<1	<1		
total suspended solids	44	1	<1	4		
pH (standard units)	44	1	6.9	7.5		

†Sample Type Code: 1 - One-time grab

TABLE V-14

PRIMARY PRECIOUS METALS AND MERCURY SUBCATEGORY
RAW WASTEWATER SELF SAMPLING DATA
(A - Silver Chloride Reduction Spent Solution)
(B - Electrolyte Preparation Wet Air Pollution Control)

Pollutant	Source A	Source B
Sample Number	88151	88150
Toxic Pollutants		
Antimony	1.86	---
Arsenic	0.479	28.36
Beryllium	<0.05	<0.05
Cadmium	0.43	0.36
Chromium	1.06	0.168
Copper	62.0	534.0
Lead	7.02	12.6
Mercury	0.086	0.014
Nickel	2.4	0.35
Silver	0.011	15.72
Thallium	<0.01	<0.01
Zinc	15.0	42.0
Nonconventional Pollutants		
Aluminum	3.0	1.1
Cobalt	0.55	0.55
Iron	5000.0	400.0
Manganese	106.0	6.4
Molybdenum	1.37	<0.5
Tin	14.0	<5.0
Titanium	<0.2	<0.2
Vanadium	1.6	1.0
Gold	<0.005	<0.005

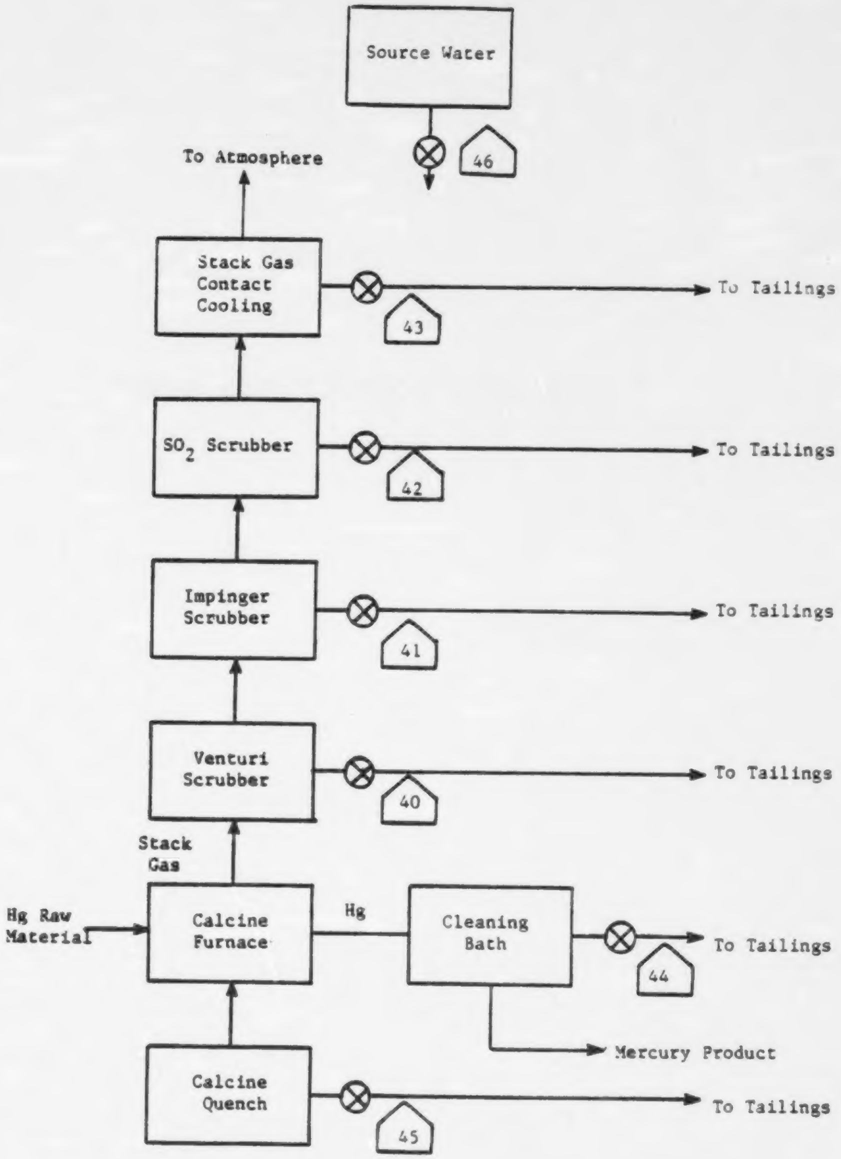
Source Water
46
To Atmosphere
Stack Gas Contact Cooling
43
To Tailings
SO2 Scrubber
42
To Tailings
Impinger Scrubber
41
To Tailings
Venturi Scrubber
40
To Tailings
Stack Gas
Hg Raw Material
Calcine Furnace
Hg
Cleaning Bath
44
To Tailings
Mercury Product
Calcine Quench
45
To Tailings

Figure V-1

SAMPLE LOCATIONS AT PRIMARY PRECIOUS METALS AND MERCURY PLANT A

SECTION VI

SELECTION OF POLLUTANT PARAMETERS

This section examines both the confidential and nonconfidential chemical analysis data and discusses the selection or exclusion of pollutants for potential limitation. The analytical data from one primary precious metals plant was not presented in Section V because it was claimed to be confidential. The basis for the regulation of toxic and other pollutants, along with a discussion of each pollutant selected for potential limitation is discussed in Section VI of Vol. I. That discussion provides information concerning the nature of the pollutant (i.e., whether it is a naturally occurring substance, processed metal, or a manufactured compound); general physical properties and the form of the pollutant; toxic effects of the pollutant in humans and other animals: and behavior of the pollutant in POTW at the concentrations expected in industrial discharges.

The discussion that follows describes the analysis that was performed to select or exclude toxic pollutants for further consideration for limitations and standards. Also, it describes the analysis that was performed to select or exclude conventional pollutants for limitation. Priority pollutants will be considered for limitation if they are present in concentrations treatable by the technologies considered in this analysis. The treatable concentrations used for the priority metals were the long-term performance values achievable by chemical precipitation, sedimentation, and filtration. The treatable concentrations used for the priority organics were the long-term performance values achievable by carbon adsorption.

This study examined samples from the primary precious metals and mercury subcategory for one nonconventional pollutant (gold) and three conventional pollutant parameters (oil and grease, total suspended solids, and pH).

CONVENTIONAL AND NONCONVENTIONAL POLLUTANT PARAMETERS SELECTED

The nonconventional and conventional pollutants or pollutant parameters selected for limitation in this subcategory are:

gold
oil and grease
total suspended solids (TSS)
pH

Gold was analyzed for and not detected in two samples of raw wastewater from this subcategory. However, gold is expected to be present in the raw wastewater because of its presence in the raw materials and its solubility in the various acids and bases used as raw materials in the refining processes. Gold was presented as being considered for regulation in the Notice of

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Data Availability (see 50 FR 10919). For these reasons, gold is selected for limitation in this subcategory.

Oil and grease was detected in two of 10 samples at concentrations above the treatability concentration of 10.0 mg/l. The measured concentrations were 60 and 170 mg/l. These high concentrations occurred in the combined raw wastewater stream from the smelter and electrolytic cells wet air pollution control and in the silver chloride reduction spent solution. Therefore, oil and grease is selected for limitation in this subcategory. TSS was detected at concentrations above the treatability concentration of 2.6 mg/l in eight of the 10 raw waste samples analyzed for this study. These eight TSS concentration values ranged from 4 to 3,700 mg/l. Furthermore, most of the specific methods used to remove toxic metals do so by converting these metals to precipitates, and these toxic metal-containing precipitates should not be discharged. Meeting a limitation on total suspended solids helps ensure that removal of these precipitated toxic metals has been effective. For these reasons, total suspended solids are selected for limitation in this subcategory.

The nine pH values observed during this study ranged from 0.9 to 8.4. Six of the nine values were equal to or less than 2.6, one value was 6.8 and the other two fell within the 7.5 to 10.0 range considered desirable for discharge to receiving waters. Many deleterious effects are caused by extreme pH values or rapid changes in pH. Also, effective removal of toxic metals by precipitation requires careful control of pH. Since pH control within the desirable limits is readily attainable by available treatment, pH is selected for limitation in this subcategory.

TOXIC PRIORITY POLLUTANTS

The frequency of occurrence of the priority pollutants in the raw wastewater samples taken is presented in Table VI-1 (page 2217). Table VI-1 is based on the raw wastewater data presented in Section V (see Tables V-10 through V-13, pages 2793-2205) as well as the primary precious metals analytical data being held confidential. These data provide the basis for the categorization of specific pollutants, as discussed below.

TOXIC POLLUTANTS NEVER DETECTED

The toxic pollutants listed in Table VI-2 (page 2221) were not detected in any raw wastewater samples from this subcategory; therefore, they are not selected for consideration in establishing limitations:

TOXIC POLLUTANTS NEVER FOUND ABOVE THEIR ANALYTICAL QUANTIFICATION CONCENTRATION

The priority pollutants listed below were never found above their analytical quantification concentration in any raw wastewater samples from this subcategory; therefore, they are not selected for consideration in establishing limitations.

65. phenol
66. bis(2-ethylhexyl) phthalate
68. di-n-butyl phthalate
78. anthracene (a)
81. phenanthrene (a)
114. antimony

(a) Reported together, as a combined value

TOXIC POLLUTANTS PRESENT BELOW CONCENTRATIONS ACHIEVABLE BY TREATMENT

The pollutants listed below are not selected for consideration in establishing limitations because they were not found in any raw wastewater samples from this subcategory above concentrations considered achievable by existing or available treatment technologies. These pollutants are discussed individually following the list.

117. beryllium
125. selenium

Beryllium was detected at a concentration of 0.15 mg/l in one of the 10 samples analyzed. Available treatment methods can reduce beryllium concentrations only to 0.2 mg/l and this pollutant is, therefore, not considered for limitation.

Selenium was detected in two of 10 samples at concentrations ranging from 0.044 to 0.063 mg/l. These concentrations are below the minimum selenium concentration of 0.2 mg/l achievable by available treatment methods. Additionally, these concentrations of selenium may be attributable to its presence in the source water at a concentration of 0.10 mg/l. Selenium, therefore, is not considered for limitation.

TOXIC POLLUTANTS DETECTED IN A SMALL NUMBER OF SOURCES

The following pollutants were not selected for limitation because they are detectable in the effluent from only a small number of sources within the subcategory and they are uniquely related to only those sources.

4. benzene
44. methylene chloride
70. diethyl phthalate
86. toluene
121. cyanide

Although these pollutants were not selected for limitation in establishing nationwide regulations, it may be appropriate, on a case-by-case basis, for the local permitter to specify effluent limitations.

Benzene was detected above its treatable concentration of 0.01 mg/l in one of three samples analyzed at a concentration of 0.016 mg/l. This pollutant is not attributable to specific materials or processes associated with the primary precious metals and mercury subcategory, and is not expected to be present in the wastewater. For this reason, and because very little removal of benzene can be expected with treatment, this pollutant is not considered for limitation.

Methylene chloride was detected above its treatability concentration of 0.01 mg/l at concentrations ranging from 0.036 to 0.046 mg/l in all three samples analyzed. This pollutant is not attributable to specific materials or processes associated with the primary precious metals and mercury subcategory, but is a common solvent used in analytical laboratories. Because methylene chloride is not expected to be present in the wastewater, as well as the high probability of sample contamination, this pollutant is not considered for limitation.

Diethyl phthalate was detected above its treatable concentration of 0.01 mg/l in one of three samples analyzed at a concentration of 0.016 mg/l. This pollutant is not attributable to specific materials or processes associated with the primary precious metals and mercury subcategory, and is not expected to be present in the wastewater. For this reason, and because very little removal of diethyl phthalate can be expected with treatment, this pollutant is not considered for limitation.

Toluene was detected above its treatable concentration of 0.01 mg/l in two of three samples analyzed at concentrations of 0.023 and 0.05 mg/l. This pollutant is not attributable to specific materials or processes associated with the primary precious metals and mercury subcategory, and is not expected to be present in the wastewater. For this reason, and because very little removal of toluene can be expected with treatment, this pollutant is not considered for limitation.

Cyanide was measured at concentrations ranging from 0.049 to 0.2 mg/l in three of the four samples for which it was analyzed. These concentrations are above the treatability concentration of 0.047 mg/l, but are suspected to be present because of source water contamination. The source water was found to contain cyanide at a concentration of 8.6 mg/l. Because of its presence in the source water at a high concentration, cyanide is not considered for limitation.

TOXIC POLLUTANTS SELECTED FOR FURTHER CONSIDERATION IN ESTABLISHING LIMITATIONS AND STANDARDS

The toxic pollutants listed below are selected for further consideration in establishing limitations and standards for this subcategory. The pollutants selected for further consideration for limitation are each discussed following the list.

115. arsenic
118. cadmium
119. chromium
120. copper
122. lead
123. mercury
124. nickel
126. silver
127. thallium
128. zinc

Arsenic was detected in two of 10 samples at concentrations of 0.6 and 17 mg/l. The concentration achievable by treatment methods is 0.34 mg/l. These concentrations were detected in silver chloride reduction spent solution and calcine quench water. Arsenic was detected, but at levels below treatability, in the other eight samples. Therefore, arsenic is selected for further consideration for limitation.

Cadmium was detected above its treatable concentration (0.049 mg/l) in two of 10 raw wastewater samples analyzed. The treatable concentrations were detected in silver chloride reduction spent solution and calcine quench water. Therefore, cadmium is selected for further consideration for limitation.

Chromium was detected above its treatable concentration of 0.07 mg/l in silver chloride reduction spent solution and calcine quench water. The highest concentration was 25 mg/l. All eight other samples indicated that chromium was present, out at a concentration below treatability. Therefore, chromium is selected for further consideration for limitation.

Copper was measured in two samples at concentrations above the treatable concentration of 0.39 mg/l. Copper was also detected in the remaining eight samples, out at concentrations below that achievable by treatment. The highest concentration of copper found was 23,000 mg/l. Therefore, copper is selected for further consideration for limitation.

Lead was detected in six raw waste streams at concentrations above the 0.08 mg/l attainable by identified treatment technology. These concentrations ranged from 0.1 to 600 mg/l. For this reason, lead is selected for further consideration for limitation.

Mercury was detected in six of the 10 samples analyzed at concentrations ranging from 0.84 to 360 mg/l. These concentrations are well above the concentration of 0.036

achievable by current treatment methods In addition, mercury was detected in the remaining four samples, but at values below the treatable concentration. For these reasons, mercury is selected for further consideration for limitation.

Nickel was detected in the silver chloride reduction spent solution at a concentration of 29 mg/l. The treatable concentration for nickel is 0.22 mg/l. Nickel was detected, but below treatable concentrations in all nine of the other samples. Therefore, nickel is selected for further consideration for limitation.

Silver was detected in two samples at concentrations of 0.13 and 6.1 mg/l. These concentrations are above silver's treatable concentration of 0.07 mg/l. Silver is, therefore, selected for further consideration for limitation.

Thallium was detected above its treatable concentration (0.34 mg/l) in two of 10 samples analyzed. The quantifiable concentrations ranged from 0.12 to 2.6 mg/l. Since thallium was present in concentrations exceeding the concentration achievable by identified treatment technology, it is selected for consideration for limitation.

Zinc was detected above its treatable concentration (0.23 mg/l) in three of 10 samples analyzed. The quantifiable concentrations ranged from 0.10 to 15.0 mg/l. Since zinc was present in concentrations exceeding the concentration achievable by identified treatment technology, it is selected for consideration for limitation.

Table VI-1

FREQUENCY OF OCCURRENCE OF PRIORITY POLLUTANTS PRIMARY PRECIOUS METALS AND MERCURY SUBCATEGORY RAW WASTEWATER

Pollutant	Analytical Quantification Concentration (mg/l)(a)	Treatable Concentration (mg/l)(b)	Number of Streams Analyzed	Number of Samples Analyzed	ND	Detected Below Quantification Concentration	Detected Below Treatable Concentration	Detected Above Treatable Concentration
1. acenaphthene	0.010	0.01	2	3	3			
2. acrolein	0.010	0.01	2	3	3			
3. acrylonitrile	0.010	0.01	2	3	3			
4. benzene	0.010	0.01	2	3		2		1
5. benzidine	0.010	0.01	2	3	3			
6. carbon tetrachloride	0.010	0.01	2	3	3			
7. chlorobenzene	0.010	0.01	2	3	3			
8. 1,2,4-trichlorobenzene	0.010	0.01	2	3	3			
9. hexachlorobenzene	0.010	0.01	2	3	3			
10. 1,2-dichloroethane	0.010	0.01	2	3	3			
11. 1,1,1-trichloroethane	0.010	0.01	2	3	3			
12. hexachloroethane	0.010	0.01	2	3	3			
13. 1,1-dichloroethane	0.010	0.01	2	3	3			
14. 1,1,2-trichloroethane	0.010	0.01	2	3	3			
15. 1,1,2,2-tetrachloroethane	0.010	0.01	2	3	3			
16. chloroethane	0.010	0.01	2	3	3			
17. bis(chloromethyl) ether	0.010	0.01	2	3	3			
18. bis(2-chloroethyl) ether	0.010	0.01	2	3	3			
19. 2-chloroethyl vinyl ether	0.010	0.01	2	3	3			
20. 2-chloronaphthalene	0.010	0.01	2	3	3			
21. 2,4,6-trichlorophenol	0.010	0.01	2	3	3			
22. parachlorometa cresol	0.010	0.01	2	3	3			
23. chloroform	0.010	0.01	2	3	3			
24. 2-chlorophenol	0.010	0.01	2	3	3			
25. 1,2-dichlorobenzene	0.010	0.01	2	3	3			
26. 1,3-dichlorobenzene	0.010	0.01	2	3	3			
27. 1,4-dichlorobenzene	0.010	0.01	2	3	3			
28. 3,3'-dichlorobenzidine	0.010	0.01	2	3	3			
29. 1,1-dichloroethylene	0.010	0.01	2	3	3			
30. 1,2-trans-dichloroethylene	0.010	0.01	2	3	3			
31. 2,4-dichlorophenol	0.010	0.01	2	3	3			
32. 1,2-dichloropropane	0.010	0.01	2	3	3			
33. 1,3-dichloropropylene	0.010	0.01	2	3	3			
34. 2,4-dimethylphenol	0.010	0.01	2	3	3			

Table VI-1 (Continued)

FREQUENCY OF OCCURRENCE OF PRIORITY POLLUTANTS PRIMARY PRECIOUS METALS AND MERCURY SUBCATEGORY RAW WASTEWATER

Pollutant	Analytical Quantification Concentration (mg/l)(a)	Treatable Concentration (mg/l)(b)	Number of Streams Analyzed	Number of Samples Analyzed	ND	Detected Below Quantification Concentration	Detected Below Treatable Concentration	Detected Above Treatable Concentration
35. 2,4-dinitrotoluene	0.010	0.01	2	3	3			
36. 2,6-dinitrotoluene	0.010	0.01	2	3	3			
37. 1,2-diphenylhydrazine	0.010	0.01	2	3	3			
38. ethylbenzene	0.010	0.01	2	3	3			
39. fluoranthene	0.010	0.01	2	3	3			
40. 4-chlorophenyl phenyl ether	0.010	0.01	2	3	3			
41. 4-bromophenyl phenyl ether	0.010	0.01	2	3	3			
42. bis(2-chloroisopropyl) ether	0.010	0.01	2	3	3			
43. bis(2-chloroethoxy) methane	0.010	0.01	2	3	3			
44. methylene chloride	0.010	0.01	2	3				
45. methyl chloride	0.010	0.01	2	3				3
46. methyl bromide	0.010	0.01	2	3	3			
47. bromoform	0.010	0.01	2	3	3			
48. dichlorobromomethane	0.010	0.01	2	3	3			
49. trichlorofluoromethane	0.010	0.01	2	3	3			
50. dichlorodifluoromethane	0.010	0.01	2	3	3			
51. chlorodibromomethane	0.010	0.01	2	3	3			
52. hexachlorobutadiene	0.010	0.01	2	3	3			
53. hexachlorocyclopentadiene	0.010	0.01	2	3	3			
54. isophorone	0.010	0.01	2	3	3			
55. naphthalene	0.010	0.01	2	3	3			
56. nitrobenzene	0.010	0.01	2	3	3			
57. 2-nitrophenol	0.010	0.01	2	3	3			
58. 4-nitrophenol	0.010	0.01	2	3	3			
59. 2,4-dinitrophenol	0.010	0.01	2	3	3			
60. 4,6-dinitro-o-cresol	0.010	0.01	2	3	3			
61. N-nitrosodimethylamine	0.010	0.01	2	3	3			
62. N-nitrosodiphenylamine	0.010	0.01	2	3	3			
63. N-nitrosodi-n-propylamine	0.010	0.01	2	3	3			
64. pentachlorophenol	0.010	0.01	2	3	3			
65. phenol	0.010	0.01	2	3	3			
66. bis(2-ethylhexyl) phthalate	0.010	0.01	2	3	2	1		
67. butyl benzyl phthalate	0.010	0.01	2	3	3	3		
68. di-n-butyl phthalate	0.010	0.01	2	3	1	2		

Table VI-1 (Continued)

FREQUENCY OF OCCURRENCE OF PRIORITY POLLUTANTS PRIMARY PRECIOUS METALS AND MERCURY SUBCATEGORY RAW WASTEWATER

Pollutant		Analytical Quantification Concentration (mg/l)(a)	Treatable Concentration (mg/l)(b)	Number of Streams Analyzed	Number of Samples Analyzed	ND	Detected Below Quantification Concentration	Detected Below Treatable Concentration	Detected Above Treatable Concentration
69. di-n-octyl phthalate		0.010	0.01	2	3	3			
70. diethyl phthalate		0.010	0.01	2	3		2		1
71. dimethyl phthalate		0.010	0.01	2	3	3			
72. benzo(a)anthracene		0.010	0.01	2	3	3			
73. benzo(a)pyrene		0.010	0.01	2	3	3			
74. 3,4-benzofluoranthene		0.010	0.01	2	3	3			
75. benzo(k)fluoranthene		0.010	0.01	2	3	3			
76. chrysene		0.010	0.01	2	3	3			
77. acenaphthylene		0.010	0.01	2	3	3			
78. anthracene	(c)	0.010	0.01	2	3		3		
79. benzo(ghi)perylene		0.010	0.01	2	3	3			
80. fluorene		0.010	0.01	2	3	3			
81. phenanthrene	(c)	0.010	0.01	2	3		3		
82. dibenzo(a,h)anthracene		0.010	0.01	2	3	3			
83. indeno(1,2,3-cd)pyrene		0.010	0.01	2	3	3			
84. pyrene		0.010	0.01	2	3	3			
85. tetrachloroethylene		0.010	0.01	2	3	3			
86. toluene		0.010	0.01	2	3		1		2
87. trichloroethylene		0.010	0.01	2	3	3			
88. vinyl chloride		0.010	0.01	2	3	3			
114. antimony		0.100	0.47	8	10		10	0	0
115. arsenic		0.010	0.34	8	10		0	8	2
117. beryllium		0.010	0.20	8	10		9	1	0
118. cadmium		0.002	0.049	8	10		6	2	2
119. chromium		0.005	0.07	8	10		5	3	2
120. copper		0.009	0.39	8	10		5	3	2
121. cyanide	(d)	0.02	0.047	2	4		0	1	3
122. lead		0.020	0.08	8	10		4	0	6
123. mercury		0.0001	0.036	8	10		0	4	6
124. nickel		0.005	0.22	8	10		6	3	1
125. selenium		0.01	0.20	8	10		8	2	0
126. silver		0.02	0.07	8	10		5	3	2

Table VI-1 (Continued)

FREQUENCY OF OCCURRENCE OF PRIORITY POLLUTANTS
PRIMARY PRECIOUS METALS AND MERCURY SUBCATEGORY
RAW WASTEWATER

Pollutant	Analytical Quantification Concentration (mg/l)(a)	Treatable Concentration (mg/l)(b)	Number of Streams Analyzed	Number of Samples Analyzed	ND	Detected Below Quantification Concentration	Detected Below Treatable Concentration	Detected Above Treatable Concentration
127. thallium	0.100	0.34	8	10		6	2	2
128. zinc	0.050	0.23	8	10		4	3	3
oil and grease	5.0	10.0	8	10		8	0	2
total suspended solids (TSS)	1.0	2.6	8	10		2	0	8

(a) Analytical quantification concentration was reported with the data (see Section V).

(b) Treatable concentrations are based on performance of chemical precipitation, sedimentation, and filtration.

(c) Reported together.

(d) Analytical quantification concentration for EPA Method 335.2, Total Cyanide Methods for Chemical Analysis of Water and Wastes, EPA 600/4-79-020, March 1979.

TABLE VI-2

TOXIC POLLUTANTS NEVER DETECTED

1. acenaphthene
2. acrolein
3. acrylonitrile
5. benzidine
6. carbon tetrachloride
7. chlorobenzene
8. 1,2,4-trichlorobenzene
9. hexachlorobenzene
10. 1,2-dichloroethane
11. 1,1,1-trichloroethane
12. hexachloroethane
13. 1,1-dichloroethane
14. 1,1,2-trichloroethane
15. 1,1,2,2-tetrachloroethane
16. chloroethane
17. bis(2-chloromethyl) ether (deleted)
18. bis(2-chloroethyl) ether
19. 2-chloroethyl vinyl ether
20. 2-chloronaphthalene
21. 2,4,6-trichlorophenol
22. parachlorometa cresol
23. chloroform
24. 2-chlorophenol
25. 1,2-dichlorobenzene
26. 1,3-dichlorobenzene
27. 1,4-dichlorobenzene
28. 3,3 -dichlorobenzidine
29. 1,1-dichloroethylene
30. 1,2-trans-dichloroethylene
31. 2,4-dichlorophenol
32. 1,2-dichloropropane
33. 1,3-dichloropropylene
34. 2,4-dimethylphenol
35. 2,4-dinitrotoluene
36. 2,6-dinitrotoluene
37. 1,2-diphenylhydrazine
38. ethylbenzene
39. fluoranthene
40. 4-chlorophenyl phenyl ether
41. 4-bromophenyl phenyl ether
42. bis(2-chloroisopropyl)ether
43. bis(2-chloroethoxy)methane
45. methyl chloride (chloromethane)
46. methyl bromide (bromomethane)
47. bromoform
48. dichlorobromomethane
49. trichlorofluoromethane (deleted)

TABLE VI-2 (Continued)

TOXIC POLLUTANTS NEVER DETECTED

50. dichlorodifluoromethane (deleted)
51. chlorodibromomethane
52. hexachlorobutadiene
53. hexachlorocyclopentadiene
54. isophorone
55. naphthalene
56. nitrobenzene
57. 2-nitrophenol
58. 4-nitrophenol
59. 2,4-dinitrophenol
60. 4,6-dinitro-o-cresol
61. N-nitrosodimethylamine
62. N-nitrosodiphenylamine
63. N-nitrosodi-n-propylamine
64. pentachlorophenol
67. butyl benzyl phthalate
69. di-n-octyl phthalate
71. dimethyl phthalate
72. benzo(a)anthracene
73. benzo(a)pyrene
74. 3,4-benzofluoranthene
75. benzo(k)fluoranthene
76. chrysene
77. acenaphthylene
79. benzo(ghi)perylene
80. fluorene
82. dibenzo(a,h)anthracene
83. indeno (1,2,3-cd)pyrene
84. pyrene
85. tetrachloroethylene
87. trichloroethylene
88. vinyl chloride
89. aldrin
90. dieldrin
91. chlordane
92. 4,4'-DDT
93. 4,4'-DDE
94. 4,4'-DDD
95. alpha-endosulfan
96. beta-endosulfan
97. endosulfan sulfate
98. endrin
99. endrin aldehyde
100. heptachlor

TABLE VI-2 (Continued)

TOXIC POLLUTANTS NEVER DETECTED

101. heptachlor epoxide
102. alpha-BHC
103. beta-BHC
104. gamma-BHC
105. delta-BHC
106. PCB.1242 (a)
107. PCB-1254 (a)
108. PCB-1221 (a)
109. PCB-1232 (b)
110. PCB-1248 (b)
111. PCB-1260 (b)
112. PCB-1016 (b)
113. toxaphene
116. asbestos
129. 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD)

(a),(b) Reported together, as a combined value

SECTION VII

CONTROL AND TREATMENT TECHNOLOGIES

The preceding sections of this supplement discussed the sources, flows, and characteristics of the wastewaters from primary precious metals and mercury plants. This section summarizes the description of these wastewaters and indicates the treatment technologies which are currently practiced in the primary precious metals and mercury subcategory for each waste stream. Secondly, this section presents the control and treatment technology options which were examined by the Agency for possible application to the primary precious metals and mercury subcategory.

CURRENT CONTROL AND TREATMENT PRACTICES

This section presents a summary of the control and treatment technologies that are currently being applied to each of the sources generating wastewater in this subcategory. As discussed in Section V, wastewater associated with the primary precious metals and mercury subcategory is characterized by the presence of the toxic metal pollutants, suspended solids, and oil and grease. This analysis is supported by the raw (untreated) wastewater data presented for specific sources. Construction of one wastewater treatment system for combined treatment allows plants to take advantage of economic scale and in some instances to combine streams of different alkalinity to reduce treatment chemical requirements.

All but one of the plants within this subcategory do not discharge wastewater. The one discharging facility discharges to a surface water from a tailings pond. Zero discharge is achieved in most plants through a combination treatment consisting of a tailings pond and recycle or reuse. One of the three plants with a smelter scrubber achieves zero discharge of that waste stream by 100 percent recycle. Partial recycle is used only on two waste streams, the smelter scrubber and the calciner scrubber wastewater. Table VII-1 (page 2227) presents a summary of the number of plants with each wastewater stream and the treatment technologies currently in place.

CONTROL AND TREATMENT OPTIONS

The Agency examined three control and treatment technology options that are applicable to the primary precious metals and mercury subcategory. The options selected for evaluation represent a combination of in-process flow reduction, preliminary treatment technologies applicable to individual waste streams, and end-of-pipe treatment technologies. The effectiveness of these technologies is discussed in Section VII of Vol. I.

OPTION A

Option A for the primary precious metals and mercury subcategory requires control and treatment technologies to reduce the discharge of wastewater pollutant mass.

The Option A treatment scheme consists of chemical precipitation and sedimentation technology and ion exchange as a polishing step. Specifically, lime or some other alkaline compound is used to precipitate metal ions as metal hydroxides. The metal hydroxides and suspended solids settle out and the sludge is collected. Vacuum filtration is used to dewater sludge.

Preliminary treatment consisting of oil skimming to remove oil and grease is also included in Option A.

OPTION B

Option B for the primary precious metals and mercury subcategory consists of the Option A (oil skimming, chemical precipitation and sedimentation, ion exchange) treatment scheme plus flow reduction techniques to reduce the discharge of wastewater volume. In-process changes which allow for recycle of electrolytic cells wastewater and calciner scrubber water are the principal control mechanisms for flow reduction.

OPTION C

Option C for the primary precious metals and mercury subcategory consists of all control and treatment requirements of Option B (in-process flow reduction, oil skimming, chemical precipitation and sedimentation, ion exchange) plus multimedia filtration technology added at the end of the Option B treatment scheme. Multimedia filtration is used to remove suspended solids, including precipitates of metals, beyond the concentration attainable by gravity sedimentation. The filter suggested is of the gravity, mixed-media type, although other forms of filters, such as rapid sand filters or pressure filters would perform satisfactorily. The addition of filters also provides consistent removal during periods in which there are rapid increases in flows or loadings of pollutants to the treatment system.

Table VII-1

SUMMARY OF WASTE STREAMS AND TREATMENT PRACTICES IN PRIMARY PRECIOUS METALS AND MERCURY PLANTS

Waste Stream	Number of Plants With Waste Stream	Number of Plants With Tailings Pond Treatment	Number of Plants With Recycle or Reuse
Smelter wet air pollution control	3	2	3
Silver chloride reduction spent solution	2	2	1
Electrolytic cells wet air pollution control	1	1	1
Electrolyte preparation wet air pollution control	1	1	0
Silver crystals wash water	1	1	0
Gold slimes acid wash and water rinse	1	1	0
Calciner wet air pollution control	1	1	1
Calcine quench water	1	1	1
Calciner stack gas contact cooling water	1	1	1
Condenser blowdown	1	1	1
Mercury cleaning bath water	1	1	1

SECTION VIII

COSTS, ENERGY, AND NONWATER QUALITY ASPECTS

This section presents a summary of compliance costs for the primary precious metals and mercury subcategory and a description of the treatment options and subcategory-specific assumptions used to develop these estimates. Together with the estimated pollutant reduction performance presented in Sections IX, X, XI, and XII of this supplement, these cost estimates provide a basis for evaluating each regulatory option. These cost estimates are also used in determining the probable economic impact of regulation on the subcategory at different pollutant discharge levels. In addition, this section addresses nonwater quality environmental impacts of wastewater treatment and control alternatives, including air pollution, solid wastes, and energy requirements, which are specific to the primary precious metals and mercury subcategory.

TREATMENT OPTIONS FOR EXISTING SOURCES

As discussed in Section VII, three treatment options have been developed for existing primary precious metals and mercury sources. The options are summarized below and schematically presented in Figures X-1 through X-3 (page 2264 - 2266).

OPTION A

Option A consists of preliminary treatment using oil-water separation where required and chemical precipitation and sedimentation and ion exchange end-of-pipe technology.

OPTION B

Option B consists of in-process flow reduction and oil-water separation preliminary treatment where required, and end-of-pipe technology consisting of chemical precipitation and sedimentation and ion exchange. The in-process flow reduction measure consists of the recycle of electrolytic cells scrubber water, and calciner scrubber water through holding tanks.

OPTION C

Option C requires the in-process flow reduction and oil-water separation preliminary treatment measures of Option B, and end-of-pipe treatment technology consisting of chemical precipitation, sedimentation, ion exchange and multimedia filtration.

COST METHODOLOGY

A detailed discussion of the methodology used to develop the compliance costs is presented in Section VIII of Vol. I. Plant-by-plant compliance costs for the nonferrous metals manufacturing category have been revised as necessary following proposal. These revisions calculate incremental costs, above treatment already in place, necessary to comply with the promulgated effluent limitations and standards and are presented in the administrative record supporting this regulation. A comparison of the costs developed for proposal and the revised costs for the final regulation are presented in Table VIII-1 (page 2230) for the direct discharger in this subcategory.

Each of the general assumptions used to develop compliance costs is presented in Section VIII of Vol. I. No subcategory-specific assumptions were used in developing compliance costs for the primary precious metals and mercury subcategory.

NONWATER QUALITY ASPECT

A general discussion of the nonwater quality aspects of the control and treatment options considered for the nonferrous metals category is contained in Section VIII of Vol. I. Nonwater quality impacts specific to the primary precious metals and mercury subcategory, including energy requirements, solid waste and air pollution, are discussed below.

ENERGY REQUIREMENTS

The methodology used for determining the energy requirements for the various options is discussed in Section VIII of the General Development Document. Energy requirements for the three options considered are estimated at 10,900 kwh/yr, 10,900 kwh/yr, and 11,200 kwh/yr for Options A, B, and C, respectively. Option B energy requirements are the same as those for Option A because the one discharging plant has no flow reduction. Option C, which includes filtration, increases energy consumption over Option B by approximately three percent. Option C represents roughly 3.5 percent of a typical plant's electrical energy usage. It is therefore concluded that the energy requirements of the treatment options considered will not have significant impact on total plant energy consumption.

SOLID WASTE

Sludge generated in the primary precious metals and mercury subcategory is due to oily wastes from oil-water separation and the precipitation of metal hydroxides and carbonates using lime.

Sludges associated with the primary precious metals and mercury subcategory will necessarily contain quantities of toxic metal pollutants. These sludges are not subject to regulation as hazardous wastes since wastes generated by primary smelters and refiners are currently exempt from regulation by Act of Congress (Resource Conservation and Recovery Act (RCRA), Section 3001(b)), as interpreted by EPA. If a small (5-10%) excess of lime is added during treatment, the Agency does not believe these sludges would be identified as hazardous under RCRA in any case.

(Compliance costs include this amount of lime.) This judgment is based on the results of Extraction Procedure (EP) toxicity tests performed on similar sludges (toxic metal-bearing sludges) generated by other industries such as the iron and steel industry. A small amount of excess lime was added during treatment, and the sludges subsequently generated passed the toxicity test. See CFR §261.24. Thus. the Agency believes that the wastewater sludges will similarly not be EP toxic if the recommended technology is applied.

Although it is the Agency's view that solid wastes generated as a result of these guidelines are not expected to be hazardous, generators of these wastes must test the waste to determine if the wastes meet any of the characteristics of hazardous waste (see 40 CFR 262.11).

If these wastes should be identified or are listed as hazardous, they will come within the scope of RCRA's "cradle to grave" hazardous waste management program, requiring regulation, from the point of generation to point of final disposition. EPA's gener-ator standards would require generators of hazardous nonferrous metals manufacturing wastes to meet containerization, labeling, recordkeeping, and reporting requirements; if plants dispose of hazardous wastes off-site, they would have to prepare a manifest which would track the movement of the wastes from the generator's premises to a permitted off-site treatment, storage, or disposal facility. See 40 CFR 262.20 45 FR 33142 (May 19, 1980), as amended at 45 FR 86973 (December 31, 1980). The transporter regulations require transporters of hazardous wastes to comply with the manifest system to assure that the wastes are delivered to a permitted facility. See 40 CFR 263.20 45 FR 33151 (May 19, 1980), as amended at 45 FR 86973 (December 31, 1980). Finally costs for wastewater treatment the cost of hauling and disposing of these wastes. For more details, see Section VIII of the General Development Document.

Sludge generation for BPT of the primary precious metals and mercury subcategory is estimated at 208 metric tons per year. Sludge generation for BAT is not expected to be significantly different.

AIR POLLUTION

There is no reason to believe that any substantial air pollution problems will result from implementation of oil-water separation, chemical precipitation, sedimentation, multimedia filtration and ion exchange. These technologies transfer pollutants to solid waste and are not likely to transfer pollutants to air.

Table VIII-1

COST OF COMPLIANCE FOR THE PRIMARY PRECIOUS METALS AND MERCURY SUBCATEGORY DIRECT DISCHARGERS

(March, 1982 Dollars)

Option	Proposal Costs Capital Cost	Proposal Costs Annual Cost	Promulgation Costs Capital Cost	Promulgation Costs Annual Cost
A	27,500	9,000	2,200	26,800
B	27,500	9,000	2,200	26,800
C	30,000	10,000	3,025	27,300

SECTION IX

BEST PRACTICABLE CONTROL TECHNOLOGY CURRENTLY AVAILABLE

This section defines the effluent characteristics attainable through the application of best practicable control technology currently available (BPT). BPT reflects the existing performance by plants of various sizes, ages, and manufacturing processes within the primary precious metals and mercury subcategory, as well as the established performance of the recommended BPT systems. Particular consideration is given to the treatment already in place at plants within the data base.

The factors considered in identifying BPT include the total cost of applying the technology in relation to the effluent reduction benefits from such application, the age of equipment and facilities involved, the manufacturing processes employed, nonwater quality environmental impacts (including energy requirements), and other factors the Administrator considers appropriate. In general, the BPT level represents the average of the existing performances of plants of various ages, sizes, processes, or other common characteristics. Where existing performance is uniformly inadequate, BPT may be transferred from a different subcategory or category. Limitations based on transfer of technology are supported by a rationale concluding that the technology is, indeed, transferable, and a reasonable prediction that it will be capable of achieving the prescribed effluent limits (see Tanner's Council of America v. Train, 540 F.2d 1188 (4th Cir. 11/6). BPT focuses on end-of-pipe treatment rather than process changes or internal controls, except where such practices are common within the subcategory.

TECHNICAL APPROACH TO BPT

The Agency studied the primary precious metals and mercury subcategory to identify the processes used, the wastewaters generated. and the treatment processes installed. Information was collected from the category using data collection portfolios, and specific plants were sampled and the wastewaters analyzed. In making technical assessments of data, reviewing manufacturing processes, and assessing wastewater treatment technology options, indirect and direct dischargers have been considered as a single group.

As explained in Section IV, the primary precious metals and mercury subcategory has been subdivided into nine potential wastewater sources. Since the water use, discharge rates, and pollutant characteristics of each of these wastewaters is potentially unique, effluent limitations will be developed for each of the nine subdivisions or segments.

For each of the subdivisions, a specific approach was followed for the development of BPT mass limitations. The first requirement to develop these limitations is to account for production and flow variability from plant to plant. Therefore, a unit of production or production normalizing parameter (PNP) was determined for each waste stream which could then be related to the flow from the process to determine a production normalized flow. Selection of the PNP for each process element is discussed in Section IV. Each process within the subcategory was then analyzed to determine (1) which subdivisions were present, (2) the specific flow rates generated for each subdivision, and (3) the specific production normalized flows for each subdivision. This analysis is discussed in detail in Section V. Nonprocess wastewaters such as rainfall runoff and noncontact cooling water are not considered in the analysis.

Production normalized flows for each subdivision were then analyzed to determine the flow to be used as part of the basis for BPT mass limitations. The selected flow (sometimes referred to as a BPT regulatory flow or BPT discharge rate) reflects the water use controls which are common practices within the category. The BPT regulatory flow is based on the average of all applicable data. Plants with normalized flows above the average may have to implement some method of flow reduction to achieve the BPT limitations.

The second requirement to calculate mass limitations is the set of concentrations that are achievable by application of the BPT level of treatment technology. Section VII discusses the various control and treatment technologies which are currently in place for each wastewater source. In most cases, the current control and treatment technologies consist of a combination of tailings ponds and reuse and recycle of process water. Chemical precipitation and sedimentation technology and performance is transferred to this subcategory, because current treatment is inadequate. Oil skimming is applied to streams with treatable concentrations of oil and grease. Ion exchange technology is being added for the removal of gold.

Using these regulatory flows and the achievable concentrations, the next step is to calculate mass loadings for each wastewater source or subdivision. This calculation was made on a stream-by-stream basis, primarily because plants in this subcategory may perform one or more of the operations in various combinations.

The mass loadings (milligrams of pollutant per troy ounce or metric ton of production - mg/T.O. or mg/kkg) were calculated by multiplying the BPT regulatory flow (l/T.O. or l/kkg) by the concentration achievable by the BPT level of treatment technology (mg/l) for each pollutant parameter to be limited under BPT. These mass loadings are published in the Federal Register and in CFR Part 421 as the effluent limitations guidelines.

The mass loadings which are allowed under BPT for each plant will be the sum of the individual mass loadings for the various wastewater sources which are found at particular plants. Accordingly, all the wastewater generated within a plant may be combined for treatment in a single or common treatment system, but the effluent limitations for these combined wastewaters are based on the various wastewater sources which actually contribute to the combined flow. This method accounts for the variety of combinations of wastewater sources and production processes which may be found at primary precious metals and mercury plants.

The Agency usually establishes wastewater limitations in terms of mass rather than concentration. This approach prevents the use of dilution as a treatment method (except for controlling pH). The production normalized wastewater flow (l/T.O. or l/kkg) is a link between the production operations and the effluent limitations. The pollutant discharge attributable to each operation can be calculated from the normalized flow and effluent concentration achievable by the treatment technology and summed to derive an appropriate limitation for each plant.

INDUSTRY COST AND POLLUTANT REMOVAL ESTIMATES

In balancing costs in relation to pollutant removal estimates, EPA considers the volume and nature of existing discharges, the volume and nature of discharges expected after application of BPT, the general environmental effects of the pollutants, and the cost and economic impacts of the required pollution control level. The Act does not require or permit consideration of water quality problems attributable to particular point sources or industries, or water quality improvements in particular water quality bodies. Accordingly, water quality considerations were not the basis for selecting the proposed or promulgated BPT. See Weyerhaeuser Company v. Costle, 590 F.2d 1011 (D.C. Cir. 1978).

The methodology for calculating pollutant removal estimates and plant compliance costs is discussed in Section X. The pollutant removal estimates have been revised since proposal based on new flow and production data submitted to EPA through industry comments. Table X-2 (page 2256) shows the estimated pollutant removals for each treatment option for direct dischargers. Compliance costs are presented in Table X-3 (page 2257).

BPT OPTION SELECTION

The technology basis for the promulgated BPT limitations is Option A, chemical precipitation and sedimentation technology to remove metals and solids from combined wastewaters and to control pH, ion exchange as a polishing step to remove gold, and oil skimming to remove oil and grease. This technology is in-place at the discharger in this subcategory. This technology differs from proposed BPT by the addition of ion exchange. The pollutants specifically promulgated for regulation at BPT are arsenic, lead, mercury, silver, zinc, oil and grease, TSS, and pH.

Implementation of the promulgated BPT limitations will remove annually an estimated 50,442 kg of priority metals and 3,310 kg of TSS. We project a capital cost of $2,200 and an annualized cost of $26,800 (1982 dollars) for achieving promulgated BPT limitations.

More stringent technology options were not selected for promulgated BPT since they require in-process changes or end-of-pipe technologies less widely practiced in the subcategory, and, therefore, are more appropriately considered under BAT.

WASTEWATER DISCHARGE RATES

A BPT discharge rate is calculated for each subdivision based on the average of the flows of the existing plants, as determined from analysis of the dcp. The discharge rate is used with the achievable treatment concentration to determine BPT effluent limitations. Since the discharge rate may be different for each wastewater source, separate production normalized discharge rates for each of the nine wastewater sources are discussed below and summarized in Table IX-1 (page 2246). The discharge rates are normalized on a production basis by relating the amount of wastewater generated to the mass of the intermediate product which is produced by the process associated with the waste stream, in question. These production normalizing parameters are also listed in Table IX-1.

Section V of this supplement further describes the discharge flow rates and presents the water use and discharge flow rates for each plant by subdivision. The proposed and promulgated BPT discharge rates are discussed individually below.

SMELTER WET AIR POLLUTION CONTROL

The BPT wastewater discharge rate proposed for smelter wet air pollution control was 13.2 liters per troy ounce (3.5 gal/troy ounce) to gold and silver smelted, based on zero percent recycle. This rate was allocated only for plants practicing wet air pollution control for the smelter. Three plants reported this waste stream, as shown in Table V-1 (page 2189). The BPT rate was based on the average water use rate for these three plants (25.8, 8.4, and 5.3 liters per troy ounce).

At proposal, EPA was considering a BPT wastewater discharge rate for this waste stream of 1.3 liters per troy ounce, based on 90 percent recycle. Recycle is demonstrated for this waste stream; three plants reporting a smelter scrubber indicated recycle rates of 76 to 100 percent on scrubber liquor. For this reason, EPA considered reducing the discharge allowance for this stream and solicited comments from industry.

The promulgated BPT wastewater discharge rate for smelter wet air pollution control is 1.3 liters per troy ounce (0.343 gal/T.O.) of gold and silver smelted. Since the Agency received no comments on this issue from industry, it decided to incorporate the 90 percent recycle rate for this waste stream. Consequently, the promulgated BPT flow is based on 90 percent recycle of the average water use reported by the three plants with this waste stream.

SILVER CHLORIDE REDUCTION SPENT SOLUTION

The proposed and promulgated BPT wastewater discharge rate for silver chloride reduction spent solution is 0.4 liters per troy ounce (0.11 gal/troy ounce) of silver reduced in solution. Water use and discharge rates are presented in Table V-2 (page 2189). The proposed BPT discharge rate was based on the flow reported by one plant. Since proposal, EPA received comments from a second plant reporting this waste stream. Flow and production data for this plant were not quantified precisely enough co calculate a production normalized flow. Thus, the promulgated BPT flow rate is based on the values reported by the initial plant and is equal to the proposed flow rate.

ELECTROLYTIC CELLS WET AIR POLLUTION CONTROL

The proposed and promulgated BPT wastewater discharge rate for the electrolytic cells wet air pollution control is 198 liters per troy ounce (52.3 gal/T.O.) of gold refined electrolytically. This normalized flow is based upon the only value reported for this subcategory. The reported water use and discharge rates are presented in Table V-3 (page 2190).

ELECTROLYTE PREPARATION WET AIR POLLUTION CONTROL

The proposed and promulgated BPT wastewater discharge rate for the electrolyte preparation wet air pollution control is 0.05 liters per troy ounce (0.013 gal/troy ounce) of silver in the electrolyte produced. This normalized flow is based upon the only value reported for this subcategory. Water use and discharge rates are provided in Table V-4 (page 2190).

CALCINER WET AIR POLLUTION CONTROL

The proposed and promulgated BPT wastewater discharge rate for the calciner wet air pollution control is 186,200 l/kkg (49,200 gal/kkg) of mercury condensed. This normalized flow is based upon the sum of the flows from three in-series scrubbers at the only facility reporting a calciner scrubber (plant 1124). Table V-5 (page 2291) summarizes the water use and discharge rates for this subdivision. This discharge rate represents 16 percent recycle of scrubber liquor, which is the rate currently achieved by the one plant with this stream.

CALCINE QUENCH WATER

The proposed and promulgated BPT wastewater discharge rate for calcine quench water is 17,600 l/kkg (4,650 gal/kkg) of mercury condensed. This production normalized discharge rate is based upon the only reported value for this waste stream. Water use and discharge rates are presented in Table V-6 (page 2191).

CALCINER STACK GAS CONTACT COOLING WATER

The proposed and promulgated BPT wastewater discharge rate selected for calciner stack gas contact cooling water is 4,150 l/kkg (1,096 gal/kkg) of mercury condensed. This discharge rate is equivalent to the discharge rate of the only plant reporting this waste stream. Table V-7 (page 2191) presents the reported water use and discharge rates for this waste stream.

CONDENSER BLOWDOWN

The proposed and promulgated BPT wastewater discharge rate for condenser blowdown is 13,800 l/kkg (3,646 gal/kkg) of mercury condensed. Water use and discharge rates for this waste stream are provided in Table V-8 (page 2192). The condenser blowdown normalized discharge rate is based upon the only value reported for this waste stream.

MERCURY CLEANING BATH WATER

The proposed and promulgated BPT wastewater discharge rate for mercury cleaning bath water is 1,400 l/kkg (370 gal/kkg) of mercury condensed. This normalized flow is equivalent to the only reported water discharge rate for this waste stream. Table V-9 (page 2192) provides the reported water use and discharge flows for this subdivision.

REGULATED POLLUTANT PARAMETERS

The raw wastewater concentrations from individual operations and the subcategory as a whole were examined to select certain pollutant parameters for limitation. This examination and evaluation is presented in Sections VI and X. Eight pollutants or pollutant parameters are selected for limitation under BPT and are listed below:

122. lead
123. mercury
126. silver
128. zinc
gold
oil and grease
total suspended solids (TSS)
pH

EFFLUENT LIMITATIONS

The concentrations achievable by application of the promulgated BPT treatment are explained in Section VII of this supplement. The achievable treatment concentrations (both one-day maximum and monthly average values) are multiplied by the BPT normalized discharge flows summarized in Table IX-1 (page 2240) to calculate the mass of pollutants allowed to be discharged per mass of product. The results of these calculations in milligrams of pollutant per troy ounce or kilogram of product represent the BPT effluent limitations and are presented in Table IX-2 (page 2241) for each individual waste stream.

Table IX-1

BPT WASTEWATER DISCHARGE RATES FOR THE PRIMARY PRECIOUS METALS AND MERCURY SUBCATEGORY

Waste Stream	BPT Discharge Rate (l/T.O. or l/kkg)	(gal/T.O. or gal/kkg)	PNP
1. Smelter wet air pollution control	1.3	0.343	troy ounce of gold and silver smelted
2. Silver chloride reduction spent solution	0.4	0.11	troy ounce of silver reduced in solution
3. Electrolytic cells wet air pollution control	198	52.3	troy ounce of silver refined electrolytically
4. Electrolyte preparation wet air pollution control	0.05	0.013	troy ounce of silver in electrolyte produced
5. Calciner wet air pollution control	186,200	49,200	kkg of mercury condensed
6. Calcine quench water	17,600	4,650	kkg of mercury condensed
7. Calciner stack gas contact cooling water	4,150	1,096	kkg of mercury condensed
8. Condenser blowdown	13,800	3,646	kkg of mercury condensed
9. Mercury cleaning bath water	1,400	370	kkg of mercury condensed

TABLE IX-2

BPT MASS LIMITATIONS FOR THE PRIMARY PRECIOUS METALS AND MERCURY SUBCATEGORY

(a) Smelter Wet Air Pollution Control BPT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/troy ounce of gold and silver smelted		
Arsenic	2.717	1.209
Cadmium	0.442	0.195
Chromium	0.572	0.234
Copper	2.470	1.300
*Lead	0.546	0.260
*Mercury	0.325	0.130
Nickel	2.496	1.651
*Silver	0.533	0.221
Thallium	2.665	1.183
*Zinc	1.898	0.793
*Gold	0.130	---
*Oil and Grease	26.000	15.600
*TSS	53.300	25.350
*pH	Within the range of 7.5 to 10.0 at all times	

(b) Silver Chloride Reduction Spent Solution BPT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/troy ounce of silver reduced in solution		
Arsenic	0.836	0.372
Cadmium	0.136	0.060
Chromium	0.176	0.072
Copper	0.760	0.400
*Lead	0.168	0.080
*Mercury	0.100	0.040
Nickel	0.768	0.508
*Silver	0.164	0.068
Thallium	0.820	0.364
*Zinc	0.584	0.244
*Gold	0.040	---
*Oil and Grease	8.000	4.800
*TSS	16.400	7.800
*pH	Within the range of 7.5 to 10.0 at all times	

*Regulated Pollutant

TABLE IX-2 (Continued)

BPT MASS LIMITATIONS FOR THE PRIMARY PRECIOUS METALS AND MERCURY SUBCATEGORY

(c) Electrolytic Cells Wet Air Pollution Control BPT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/troy ounce of silver refined electrolytically		
Arsenic	413.800	184.100
Cadmium	67.320	29.700
Chromium	87.120	35.640
Copper	376.200	198.000
*Lead	83.160	39.600
*Mercury	49.500	19.800
Nickel	380.200	251.500
*Silver	81.180	33.660
Thallium	405.900	180.200
*Zinc	289.100	120.800
*Gold	19.800	---
*Oil and Grease	3,960.000	2,376.000
*TSS	8,118.000	3,861.000
*pH	Within the range of 7.5 to 10.0 at all times	

(d) Electrolyte Preparation Wet Air Pollution Control BPT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/troy ounce of silver in electrolyte produced		
Arsenic	0.105	0.047
Cadmium	0.017	0.008
Chromium	0.022	0.009
Copper	0.095	0.050
*Lead	0.021	0.010
*Mercury	0.013	0.005
Nickel	0.096	0.064
*Silver	0.021	0.009
Thallium	0.103	0.046
*Zinc	0.073	0.031
*Gold	0.005	---
*Oil and Grease	1.000	0.600
*TSS	2.050	0.975
*pH	Within the range of 7.5 to 10.0 at all times	

*Regulated Pollutant

TABLE IX-2 (Continued)

BPT MASS LIMITATIONS FOR THE PRIMARY PRECIOUS METALS AND MERCURY SUBCATEGORY

(e) Calciner Wet Air Pollution Control BPT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of mercury condensed		
Arsenic	389.200	173.200
Cadmium	63.310	27.930
Chromium	81.930	33.520
Copper	353.800	186.200
*Lead	78.200	37.240
*Mercury	46.550	18.620
Nickel	357.500	236.500
*Silver	76.340	31.650
Thallium	381.700	169.400
*Zinc	271.900	113.600
*Gold	18.620	---
*Oil and Grease	3,724.000	2,234.000
*TSS	7,634.000	3,631.000
*pH	Within the range of 7.5 to 10.0 at all times	

(f) Calcine Quench Water BPT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of mercury condensed		
Arsenic	36.780	16.370
Cadmium	5.984	2.640
Chromium	7.744	3.168
Copper	33.440	17.600
*Lead	7.392	3.520
*Mercury	4.400	1.760
Nickel	33.790	22.350
*Silver	7.216	2.992
Thallium	36.080	16.020
*Zinc	25.700	10.740
*Gold	1.760	---
*Oil and Grease	352.000	211.200
*TSS	721.600	343.200
*pH	Within the range of 7.5 to 10.0 at all times	

*Regulated Pollutant

TABLE IX-2 (Continued)

BPT MASS LIMITATIONS FOR THE PRIMARY PRECIOUS METALS AND MERCURY SUBCATEGORY

(g) Calciner Stack Gas Contact Cooling Water BPT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of mercury condensed		
Arsenic	8.674	3.860
Cadmium	1.411	0.623
Chromium	1.826	0.747
Copper	7.885	4.150
*Lead	1.743	0.830
*Mercury	1.038	0.415
Nickel	7.968	5.271
*Silver	1.702	0.706
Thallium	8.508	3.777
*Zinc	6.059	2.532
*Gold	0.415	---
*Oil and Grease	83.000	49.800
*TSS	170.200	80.930
*pH	Within the range of 7.5 to 10.0 at all times	

(h) Condenser Blowdown BPT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of mercury condensed		
Arsenic	28.840	12.830
Cadmium	4.692	2.070
Chromium	6.072	2.484
Copper	26.220	13.800
*Lead	5.796	2.760
*Mercury	3.450	1.380
Nickel	26.500	17.530
*Silver	5.658	2.346
Thallium	28.290	12.560
*Zinc	20.150	8.418
*Gold	1.380	---
*Oil and Grease	276.000	165.600
*TSS	565.800	269.100
*pH	Within the range of 7.5 to 10.0 at all times	

*Regulated Pollutant

TABLE IX-2 (Continued)

BPT MASS LIMITATIONS FOR THE PRIMARY PRECIOUS METALS AND MERCURY SUBCATEGORY

(i) Mercury Cleaning Bath Water BPT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of mercury condensed		
Arsenic	2.926	1.302
Cadmium	0.476	0.210
Chromium	0.616	0.252
Copper	2.660	1.400
*Lead	0.588	0.280
*Mercury	0.350	0.140
Nickel	2.688	1.778
*Silver	0.574	0.238
Thallium	2.870	1.274
*Zinc	2.044	0.854
*Gold	0.140	---
*Oil and Grease	28.000	16.800
*TSS	57.400	27.300
*pH	Within the range of 7.5 to 10.0 at all times	

*Regulated Pollutant

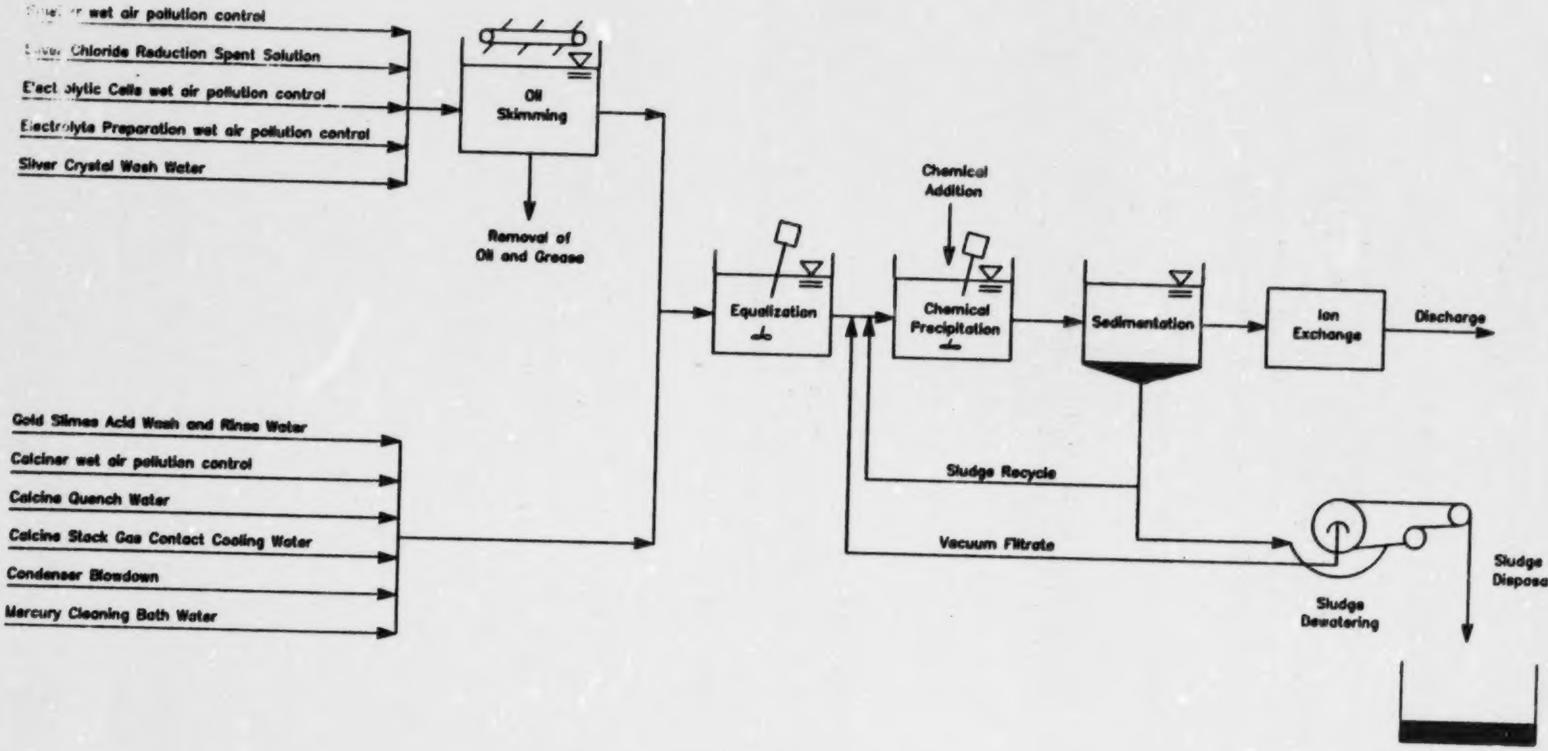
Smelter wet air pollution control
Silver Chloride Reduction Spent Solution
Electrolytic Cells wet air pollution control
Electrolyte Preparation wet air pollution control
Silver Crystal Wash Water
Gold Slimes Acid Wash and Rinse Water
Calciner wet air pollution control
Calcine Quench Water
Calcine Stack Gas Contact Cooling Water
Condenser Blowdown
Mercury Cleaning Bath Water
Oil Skimming
Removal of Oil and Grease
Equalization
Chemical Addition
Chemical Precipitation
Sedimentation
Ion Exchange
Discharge
Sludge Recycle
Vacuum Filtrate
Sludge Dewatering
Sludge to Disposal

FIGURE IX-1 BPT TREATMENT SCHEME FOR THE PRIMARY PRECIOUS METALS AND MERCURY SUBCATEGORY

SECTION X

BEST AVAILABLE TECHNOLOGY ECONOMICALLY ACHIEVABLE

These effluent limitations are based on the best control and treatment technology used by a specific point source within the industrial category or subcategory, or by another category where it is readily transferable. Emphasis is placed on additional treatment techniques applied at the end of the treatment systems currently used, as well as reduction of the amount of water used and discharged, process control, and treatment technology optimization.

The factors considered in assessing best available technology economically achievable (BAT) include the age of equipment and facilities involved, the process used, process changes, nonwater quality environmental impacts (including energy requirements), and the costs of application of such technology (Section 304(b) (2)(B) of the Clean Water Act). BAT represents the best available technology economically achievable at plants of various ages, sizes, processes, or other characteristics. BAT may include feasible process changes or internal controls, even when not in common practice.

The statutory assessment of BAT considers costs, but does not require a balancing of costs against pollutant removals However, in assessing the proposed and promulgated BAT, the Agency has given substantial weight to the economic achievability of the technology.

TECHNICAL APPROACH TO BAT

The Agency reviewed a wide range of technology options and evaluated the available possibilities to ensure that the most effective and beneficial technologies were used as the basis of BAT. To accomplish this, the Agency elected to examine three technology options which could be applied to the primary precious metals and mercury subcategory as alternatives for the basis of BAT effluent limitations.

For the development of BAT effluent limitations, mass loadings were calculated for each wastewater source or subdivision in the subcategory using the same technical approach as described in Section IX for BPT limitations development. The differences in the mass loadings for BPT and BAT are due to increased treatment effectiveness achievable with the more sophisticated BAT treatment technology and reductions in the effluent flows allocated to various waste streams.

In summary, the treatment technologies considered for the primary precious metals and mercury subcategory are:

Option A (Figure X-1, page 2264):

- Oil skimming preliminary treatment for streams containing oil and grease at treatable concentrations
- Chemical precipitation and sedimentation
- Ion exchange

Option B (Figure X-2 page 2265) is based on

- In-process flow reduction of wet air pollution control water
- Oil skimming preliminary treatment for streams containing oil and grease at treatable concentrations
- Chemical precipitation and sedimentation
- Ion exchange

Option C (Figure X-3 page 2266) is based on

- In-process flow reduction of wet air pollution control water
- Oil skimming preliminary treatment for streams containing oil and grease at treatable concentrations
- Chemical precipitation and sedimentation
- Multimedia filtration
- Ion exchange

The three options examined for BAT are further discussed below. The first option considered is the same as the BPT treatment technology which was presented in section IX.

OPTION A

Option A for the primary precious metals and mercury subcategory is equivalent to the control and treatment technologies which were analyzed for BPT in Section IX. The BPT end-of-pipe treatment scheme includes chemical precipitation and sedimentation (lime and settle) technology, with oil skimming preliminary treatment of wastewaters containing treatable concentrations of oil and grease and ion exchange as a polishing step (see Figure X-1). The discharge rates for Option A are equal to the discharge rates allocated to each stream as a BPT discharge flow.

OPTION B

Option B for the primary precious metals and mercury subcategory achieves lower pollutant discharge by building upon the Option A (oil skimming preliminary treatment, chemical precipitation and sedimentation and ion exchange) treatment technology. Flow reduction measures are added to the Option A treatment scheme (see Figure X-2). These flow reduction measures, including in-process changes, result in the concentration of pollutants in some wastewater streams. As explained in Section VII of the General Development Document, treatment of a more concentrated effluent allows achievement of a greater net pollutant removal and introduces the possible economic benefits associated with treating a lower volume of wastewater.

Option B flow reduction measures are reflected in the BAT wastewater discharge rates. Flow reduction has been included in determining the promulgated BAT discharge rates for electrolytic cells wet air pollution control and calciner wet air pollution control. Based on available data, the Agency did not feel that further flow reduction over BPT would be feasible for the remaining seven waste streams in the primary precious metals and mercury subcategory. These waste streams are:

1. Smelter wet air pollution control,
2. Silver chloride reduction spent solution,
3. Electrolyte preparation wet air pollution control,
4. Calcine quench water,
5. Calciner stack gas contact cooling water,
6. Condenser blowdown, and
7. Mercury cleaning bath water.

Flow reduction measures used in Option B to reduce process wastewater generation or discharge rates include the following:

Recycle of Water Used in Wet Air Pollution Control

There are four wastewater sources associated with wet air pollution control which are regulated under the primary precious metals and mercury subcategory:

1. Smelter wet air pollution control,
2. Electrolytic cells wet air pollution control,
3. Electrolyte preparation wet air pollution control, and
4. Calciner wet air pollution control.

Table X-1 (page 2255) presents the number of plants reporting wastewater from the wet air pollution control sources listed above, the number of plants practicing recycle, and the range of recycle values being listed. Recycle of electrolytic cell scrubber water and calciner scrubber water are required for BAT. Recycle of smelter wet air pollution control and electrolyte preparation wet air pollution control is not required for BAT because the BPT discharge flow is close to the minimum possible water discharge from a scrubber. The recycle rate used for the other two sources is based on 90 percent recycle of the average water use reported by all the plants with each waste stream, as will be shown later.

OPTION C

Option C for the primary precious metals and mercury subcategory consists of all control and treatment requirements of Option B (in-process flow reduction, oil skimming preliminary treatment, chemical precipitation, sedimentation, and ion exchange) plus multimedia filtration technology added at the end of the Option B treatment scheme (see Figure X-3, page 2266). Multimedia filtration is used to remove suspended solids, including precipitates of toxic metals, beyond the concentration attainable by gravity sedimentation. The filter suggested is of the gravity, mixed media type, although other filters, such as rapid sand filters or pressure filters, would perform satisfactorily.

INDUSTRY COST AND POLLUTANT REMOVAL ESTIMATES

As one means of evaluating each technology option, EPA developed estimates of the pollutant removal benefits and the compliance costs associated with each option. The methodologies are described below.

POLLUTANT REMOVAL ESTIMATES

A complete description of the methodology used to calculate the estimated pollutant removal, or benefit, achieved by the application of the various treatment options is presented in Section X of Vol. I. The pollutant removal estimates have been revised from proposal because of additional flow and production information received during the comment period. The methodology for calculating pollutant removals has not changed, and the data used for estimating removals are the same as those used to revise compliance costs.

Sampling data collected during the field sampling program were used to characterize the major waste streams considered for regulation. At each sampled facility, the sampling data was production normalized for each unit operation (i.e., mass of pollutant generated per mass of product manufactured). This value, referred to as the raw waste, was used to estimate the mass of toxic pollutants generated within the primary precious metals and mercury subcategory. The pollutant removal estimates were calculated for each plant by first estimating the total mass of each pollutant in the untreated wastewater. This was calculated by first multiplying the raw waste values by the corresponding production value for that stream and then summing these values for each pollutant for every stream generated by the plant.

Next, the volume of wastewater discharged after the application of each treatment option was estimated for each operation at each plant by comparing the actual discharge to the regulatory flow. The smaller of the two values was selected and summed with the other plant flows. The mass of pollutant discharged was then estimated by multiplying the achievable concentration values attainable with the option (mg/l) by the estimated volume of process wastewater discharged by the subcategory. The mass of pollutant removed is the difference between the estimated mass of pollutant generated within the subcategory and the mass of pollutant discharged after application of the treatment option. The pollutant removal estimates for direct dischargers in the primary precious metals and mercury subcategory are presented in Table X-2 (page 2256).

COMPLIANCE COSTS

In estimating subcategory-wide compliance costs, the first step was to develop a cost estimation model, relating the total costs associated with installation and operation of wastewater treatment technologies to plant process wastewater discharge. EPA applied the model to each plant. The plant's investment and operating costs are determined by what treatment it has in place and by its individual process wastewater discharge flow. As discussed above, this flow is either the actual or the BAT regulatory flow, whichever is lesser. The final step was to annualize the capital costs, and to sum the annualized capital costs, and the operating and maintenance costs for each plant, yielding the cost of compliance for the subcategory (see Table X-3, page 2257). These costs were used in assessing economic achievability.

BAT OPTION SELECTION - PROPOSAL

EPA selected Option C for the proposed BAT, which included flow reduction, oil skimming preliminary treatment, chemical precipitation and sedimentation, and multimedia filtration.

The pollutants proposed for limitation under BAT were arsenic, lead, mercury, silver, and zinc. Implementation of the proposed BAT limitations was estimated to remove 914.5 kilograms of toxic metals annually. Estimated capital cost for achieving proposed BAT was $30,000 and annual cost was $10,000 (1982 dollars).

BAT OPTION SELECTION - PROMULGATION

EPA is promulgating BAT limitations for this subcategory based on flow reduction, oil skimming preliminary treatment, chemical precipitation and sedimentation, ion exchange and multimedia filtration. This preliminary treatment and end-of-pipe technology basis for the promulgated BAT adds ion exchange to the technology used for the proposed BAT limitations. The treatment performance concentrations upon which the mass limitations are based are equal to those used to calculate the proposed mass limitations.

EPA is promulgating multimedia filtration as part of the BAT technology because this technology results in additional removal of toxic metals. Filtration is also presently demonstrated at 25 plants throughout the nonferrous metals manufacturing category. Filtration adds reliability to the treatment system by making it less susceptible to operator error and to sudden changes in raw wastewater flow and pollutant concentrations.

Oil skimming is demonstrated in the nonferrous metals manufacturing category. Although no primary precious metals and mercury plants have oil skimming in place, it is necessary to reduce oil and grease concentrations in the discharge from this subcategory.

EPA has added ion exchange end-of-pipe treatment to the BAT treatment scheme discussed at proposal. Ion exchange is an effective method for removing gold from wastewater generated in the subcategory. EPA has determined that no additional costs will be generated in the secondary precious metals subcategory by adding ion exchange because of the value of the precious metals recovered in the column, and believes this will also be true for primary precious metals subcategory.

Implementation of the control and treatment technologies of Option C will remove annually an estimated 50,443 kilograms of priority metal pollutants from raw wastewater. The estimated capital cost for achieving promulgated BAT is $3,025 (1982 dollars) and the estimated annual cost is $27,300 (1982 dollars).

WASTEWATER DISCHARGE RATES

A BAT discharge rate was calculated for each subdivision based upon the flows of the existing plants, as determined from analysis of the data collection portfolios. The discharge rate is used with the achievable treatment concentrations to determine BAT effluent limitations. Since the discharge rate may be different for each wastewater source, separate production normalized discharge rates for each of the nine wastewater sources were determined and are summarized in Table X-4 (page 2258). The discharge rates wastewater generated to the mass of the intermediate product which is produced by the process associated with the waste stream in question. These production normalizing parameters (PNP) are also listed in Table X-4. The discharge rates are normalized on a production basis by relating the amount of wastewater generated to the mass of the intermediate product which is produced by the process associated with the waste stream in question. These production normalizing parameters (PNP) are also listed in Table X-4.

The promulgated BAT discharge rates are the same as the discharge rates proposed for BAT. As discussed previously, the promulgated BAT wastewater discharge rate equals the BPT wastewater discharge rate for seven of the nine waste streams in the primary precious metals and mercury subcategory. Based on the available data, the Agency determined that further flow reduction would not be feasible for these seven wastewater sources. Wastewater streams for which BAT discharge rates differ from BPT are discussed below.

ELECTROLYTIC CELLS WET AIR POLLUTION CONTROL

The promulgated BAT wastewater discharge rate for electrolytic cells wet air pollution control is 19.8 liters per troy ounce of gold refined electrolytically. This rate is based on 90 percent recycle of the water use rate reported by the one plant with this waste stream, as shown in Table V-3 (page 2190). Although recycle of this stream is not currently demonstrated, the Agency believes that it is achievable.

CALCINER WET AIR POLLUTION CONTROL

The promulgated BAT wastewater discharge rate for calciner wet air pollution control is 22,000 liters per metric ton of mercury condensed. This rate is based on 90 percent recycle of the water use rate reported by the only plant with this waste stream. As shown in Table V-5 (page 2191), the plant reported a flow of 186,000 l/kkg, which represents a 16 percent recycle rate. The BAT rate was determined by the following formula:

$$\frac{(186{,}000\ \text{l/kkg})\ (1.00 - 0.90)}{(1.00 - 0.16)} = 22{,}000\ \text{l/kkg}$$

Although 90 percent recycle is not demonstrated for this waste stream, the Agency believes it is achievable.

REGULATED POLLUTANT PARAMETERS

In implementing the terms of the Consent Agreement in NRDC v. Train, Op. Cit., and 33 U.S.C.c1314(b)(2)(A and B) (1976), the Agency placed particular emphasis on the toxic pollutants. The raw wastewater concentrations from individual operations and the subcategory as a whole were examined to select certain pollutant parameters for consideration for limitation. This examination and evaluation, presented in Section VI, concluded that 10 pollutants are present in primary precious metals and mercury wastewaters at concentrations than can be effectively reduced by identified treatment technologies (refer to Section VI).

The high cost associated with analysis for toxic metal pollutants has prompted EPA to develop an alternative method for regulating and monitoring toxic pollutant discharges from the nonferrous metals manufacturing category. Rather than developing specific effluent mass limitations and standards for each of the toxic metals found in treatable concentrations in the raw wastewaters from a given subcategory, the Agency is promulgating effluent mass limitations only for those pollutants generated in the greatest quantities as shown by the pollutant removal analysis. The pollutants selected for specific limitation are listed below:

122. lead
123. mercury
126. silver
128. zinc
gold

By establishing limitations and standards for certain toxic metal pollutants, dischargers will attain the same degree of control over the other toxic metal pollutants as they would have been required to achieve had all the priority metal pollutants been directly limited.

This approach is technically justified since the treatment effectiveness concentrations used for chemical precipitation and sedimentation technology are based on optimized treatment for concomitant multiple metals removal. Thus, even though metals have somewhat different theoretical solubilities, they will be removed at very nearly the same rate in a chemical precipitation and sedimentation treatment system operated for multiple metals removal. Filtration as part of the technology basis is likewise justified because this technology removes metals non-preferentially.

The toxic metal pollutants selected for specific limitation in the primary precious metals and mercury subcategory to control the discharges of other toxic metal pollutants are lead, mercury, silver, and zinc.

Gold is selected for limitation in this subcategory because the methods used to control lead, mercury, silver and zinc are not effective in controlling the discharge of gold.

The following priority pollutants are excluded from limitation on the basis that they are effectively controlled by the limitations develope for lead, mercury, silver, zinc and gold.

115. arsenic
118. cadmium
119. chromium
120. copper
124. nickel
127. thallium

EFFLUENT LIMITATIONS

The concentrations achievable by application of the BAT technology (Option C) are discussed in Section VII of this supplement. These treatment effectiveness concentrations (both one-day maximum and monthly average) are multiplied by the BAT normalized discharge flows summarized in Table X-4 (page 2258) to calculate the mass of pollutants allowed to be discharged per mass of product. The results of these calculations in milligrams of pollutant per troy ounce or kilogram of product represent the promulgated BAT effluent limitations for the primary precious metals and mercury subcategory. BAT effluent limitations based on Option C (oil skimming, chemical precipitation, sedimentation, in-process flow reduction, ion exchange and multimedia filtration) are presented in Table X-5 (page 2259).

TABLE X-1

CURRENT RECYCLE PRACTICES WITHIN THE PRIMARY PRECIOUS METALS AND MERCURY SUBCATEGORY

	Number of Plants With Wastewater	Number of Plants Practicing Recycle	Range of Recycle Values (%)
Smelter wet air pollution control	3	3	76-100
Electrolytic cells wet air pollution control	1	0	0
Electrolyte preparation wet air pollution control	1	0	0
Calciner wet air pollution control	1	1	16

TABLE X-2

CURRENT RECYCLE PRACTICES WITHIN THE PRIMARY PRECIOUS METALS AND MERCURY SUBCATEGORY

	Number of Plants With Wastewater	Number of Plants Practicing Recycle	Range of Recycle Values (%)
Smelter wet air pollution control	3	3	76 - 100
Electrolytic Cells Wet Air Pollution Control	1	0	0
Electrolytic Preparation Wet Air Pollution Control	1	0	0
Calciner Wet Air Pollution Control	1	1	16

TABLE X-3

COST OF COMPLIANCE FOR THE PRIMARY PRECIOUS METALS AND MERCURY SUBCATEGORY
DIRECT DISCHARGERS

(March, 1982 Dollars)

	Proposal Costs		Promulgation Costs	
Option	Capital Cost	Annual Cost	Capital Cost	Annual Cost
A	27,500	9,000	2,200	26,800
B	27,500	9.000	2,200	26,800
C	30,000	10,000	3,025	27,300

TABLE X-4

BPT WASTEWATER DISCHARGE RATES FOR THE PRIMARY PRECIOUS METALS AND MERCURY SUBCATEGORY

	NSPS Discharge Rate		
Waste Stream	(l/T.O. or l/kkg)	(gal/T.O. or gal/kkg)	PNP
1. Smelter wet air pollution control	1.3	0.343	troy ounce of gold and silver smelted
2. Silver chloride reduction spent solution	0.4	0.11	troy ounce of silver reduced in solution
3. Electrolytic cells wet air pollution control	19.8	5.23	troy ounce of gold refined electrolytically
4. Electrolyte preparation wet air pollution control	0.05	0.013	troy ounce of silver in electrolyte produced
5. Calciner wet air pollution control	22,000	5,812	kkg of mercury condensed
6. Calcine quench water	17,600	4,650	kkg of mercury condensed
7. Calciner stack gas contact cooling water	4,150	1,096	kkg of mercury condensed
8. Condenser blowdown	13,800	3,646	kkg of mercury condensed
9. Mercury cleaning bath water	1,400	370	kkg of mercury condensed

TABLE X-5

BAT MASS LIMITATIONS FOR THE PRIMARY PRECIOUS METALS AND MERCURY SUBCATEGORY

(a) Smelter Wet Air Pollution Control BAT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/troy ounce of gold and silver smelted		
Arsenic	1.807	0.806
Cadmium	0.260	0.104
Chromium	0.481	0.195
Copper	1.664	0.793
*Lead	0.364	0.169
*Mercury	0.195	0.078
Nickel	0.715	0.481
*Silver	0.377	0.156
Thallium	1.820	0.793
*Zinc	1.326	0.546
*Gold	0.130	---

(b) Silver Chloride Reduction Spent Solution BAT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/troy ounce of silver reduced in solution		
Arsenic	0.556	0.248
Cadmium	0.080	0.032
Chromium	0.148	0.060
Copper	0.512	0.244
*Lead	0.112	0.052
*Mercury	0.060	0.024
Nickel	0.220	0.148
*Silver	0.116	0.048
Thallium	0.560	0.244
*Zinc	0.408	0.168
*Gold	0.040	---

*Regulated Pollutant

TABLE X-5 (Continued)

BAT MASS LIMITATIONS FOR THE PRIMARY PRECIOUS METALS AND MERCURY SUBCATEGORY

(c) Electrolytic Cells Wet Air Pollution Control BAT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/troy ounce of silver refined electrolytically		
Arsenic	27.520	12.280
Cadmium	3.960	1.584
Chromium	7.326	2.970
Copper	25.340	12.080
*Lead	5.544	2.574
*Mercury	2.970	1.188
Nickel	10.890	7.326
*Silver	5.742	2.376
Thallium	27.720	12.080
*Zinc	20.200	8.316
*Gold	1.980	---

(d) Electrolyte Preparation Wet Air Pollution Control BAT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/troy ounce of silver in electrolyte produced		
Arsenic	0.070	0.031
Cadmium	0.010	0.004
Chromium	0.019	0.008
Copper	0.064	0.031
*Lead	0.014	0.007
*Mercury	0.008	0.003
Nickel	0.028	0.019
*Silver	0.015	0.006
Thallium	0.070	0.031
*Zinc	0.051	0.021
*Gold	0.005	---

*Regulated Pollutant

TABLE X-5 (Continued)

BAT MASS LIMITATIONS FOR THE PRIMARY PRECIOUS METALS AND MERCURY SUBCATEGORY

(e) Calciner Wet Air Pollution Control BAT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of mercury condensed		
Arsenic	30.580	13.640
Cadmium	4.400	1.760
Chromium	8.140	3.300
Copper	28.160	13.420
*Lead	6.160	2.860
*Mercury	3.300	1.320
Nickel	12.100	8.140
*Silver	6.380	2.640
Thallium	30.800	13.420
*Zinc	22.440	9.240
*Gold	2.200	---

(f) Calciner Quench Water BAT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
(lb/million lbs) of mercury condensed		
Arsenic	24.460	10.910
Cadmium	3.520	1.408
Chromium	6.512	2.640
Copper	22.530	10.740
*Lead	4.928	2.288
*Mercury	2.640	1.056
Nickel	9.680	6.512
*Silver	5.104	2.112
Thallium	24.640	10.740
*Zinc	17.950	7.392
*Gold	1.760	---

*Regulated Pollutant

TABLE X-5 (Continued)

BAT MASS LIMITATIONS FOR THE PRIMARY PRECIOUS METALS AND MERCURY SUBCATEGORY

(g) Calciner Stack Gas Contact Cooling Water BAT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of mercury condensed		
Arsenic	5.769	2.573
Cadmium	0.830	0.332
Chromium	1.536	0.623
Copper	5.312	2.532
*Lead	1.162	0.540
*Mercury	0.623	0.249
Nickel	2.283	1.536
*Silver	1.204	0.498
Thallium	5.810	2.532
*Zinc	4.233	1.743
*Gold	0.415	---

(h) Condenser Blowdown BAT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of mercury condensed		
Arsenic	19.180	8.556
Cadmium	2.760	1.104
Chromium	5.106	2.070
Copper	17.660	8.418
*Lead	3.864	1.794
*Mercury	2.070	0.828
Nickel	7.590	5.106
*Silver	4.002	1.656
Thallium	19.320	8.418
*Zinc	14.080	5.796
*Gold	1.380	---

*Regulated Pollutant

TABLE X-5 (Continued)

BAT MASS LIMITATIONS FOR THE PRIMARY PRECIOUS METALS AND MERCURY SUBCATEGORY

(i) Mercury Cleaning Bath Water BAT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of mercury condensed		
Arsenic	1.946	0.868
Cadmium	0.280	0.112
Chromium	0.518	0.210
Copper	1.792	0.854
*Lead	0.392	0.182
*Mercury	0.210	0.084
Nickel	0.770	0.518
*Silver	0.406	0.168
Thallium	1.960	0.854
*Zinc	1.428	0.588
*Gold	0.140	---

*Regulated Pollutant

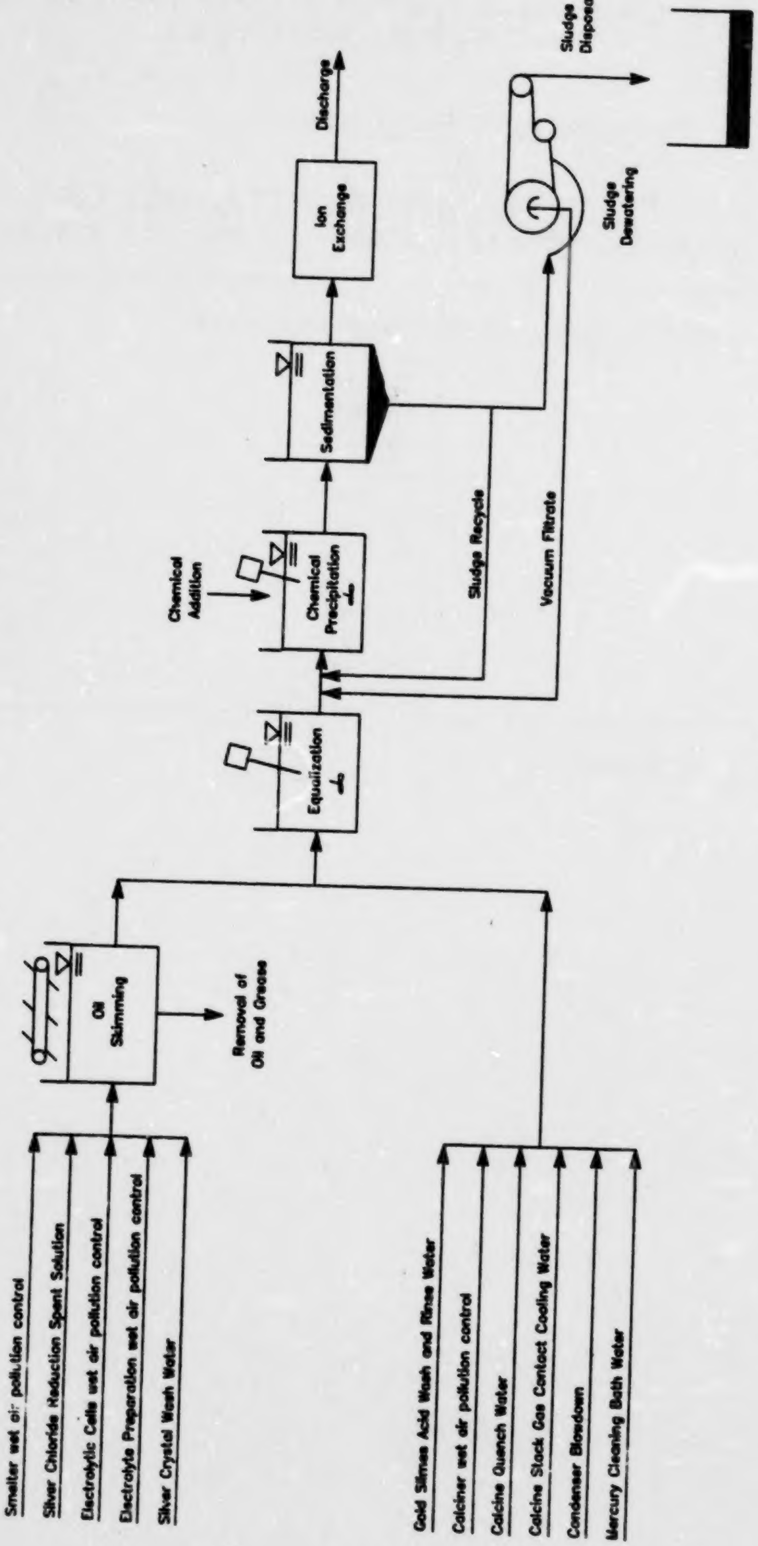
Smelter wet air pollution control
Silver Chloride Reduction Spent Solution
Electrolytic Cells wet air pollution control
Electrolyte Preparation wet air pollution control
Silver Crystal Wash Water
Gold Slimes Acid Wash and Rinse Water
Calciner wet air pollution control
Calcine Quench Water
Calcine Stack Gas Contact Cooling Water
Condenser Blowdown
Mercury Cleaning Bath Water
Oil Skimming
Removal of Oil and Grease
Equalization
Chemical Addition
Chemical Precipitation
Sedimentation
Sludge Recycle
Vacuum Filtrate
Ion Exchange
Discharge
Sludge Dewatering
Sludge to Disposal

FIGURE X-1 BAT TREATMENT SCHEME FOR OPTION A

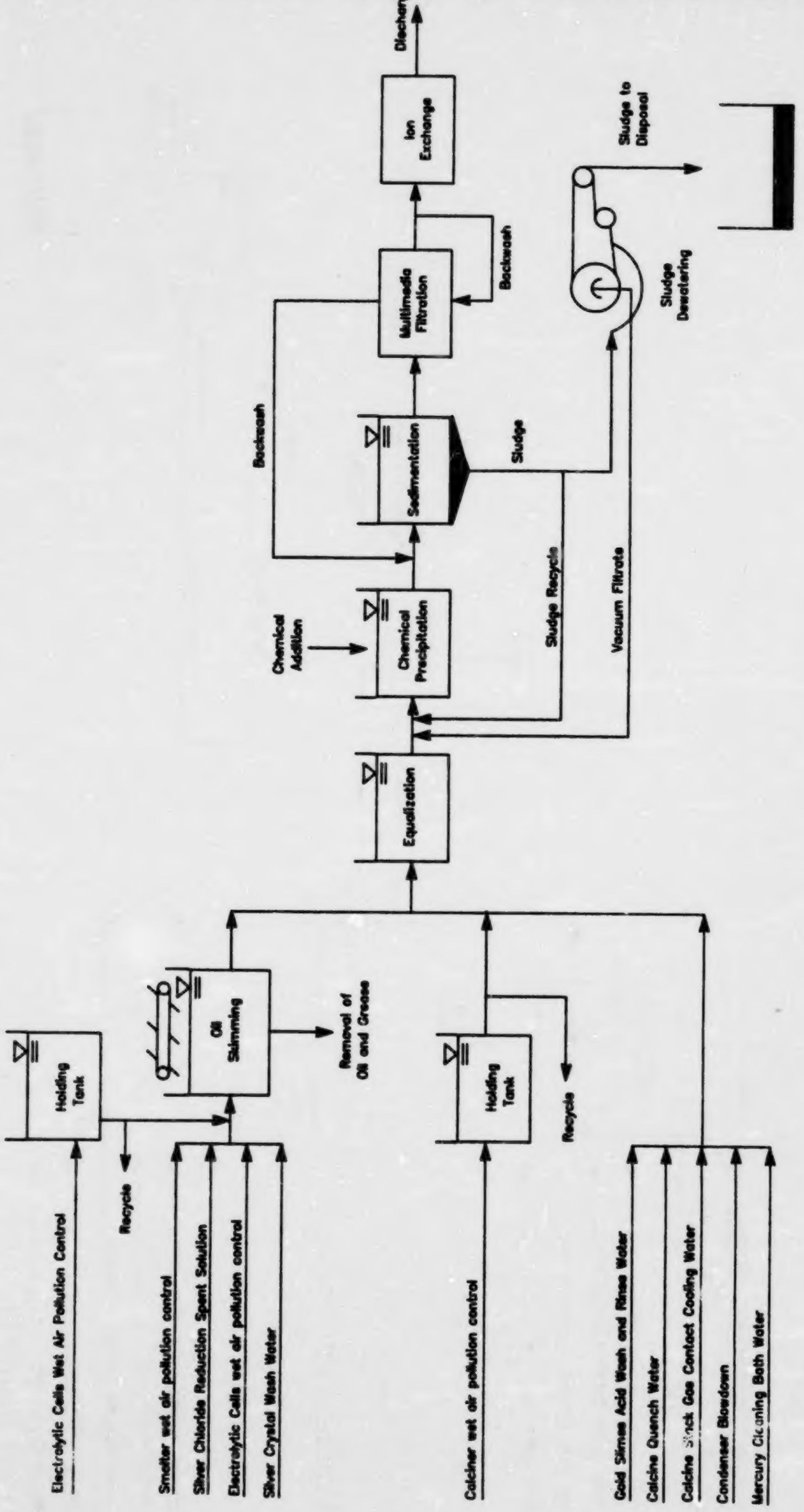
Electrolytic Cells Wet Air Pollution Control
Recycle
Holding Tank
Smelter wet air pollution control
Silver Chloride Reduction Spent Solution
Electrolytic Cells wet air pollution control
Silver Crystal Wash Water
Oil Skimming
Removal of Oil and Grease
Calciner wet air pollution control
Holding Tank
Recycle
Gold Slimes Acid Wash and Rinse Water
Calcine Quench Water
Calcine Stack Gas Contact Cooling Water
Condenser Blowdown
Mercury Cleaning Bath Water
Equalization
Chemical Addition
Chemical Precipitation
Sludge Recycle
Vacuum Filtrate
Sedimentation
Sludge
Backwash
Multimedia Filtration
Backwash
Ion Exchange
Discharge
Sludge Dewatering
Sludge to Disposal

FIGURE X-2 BAT TREATMENT SCHEME FOR OPTION B

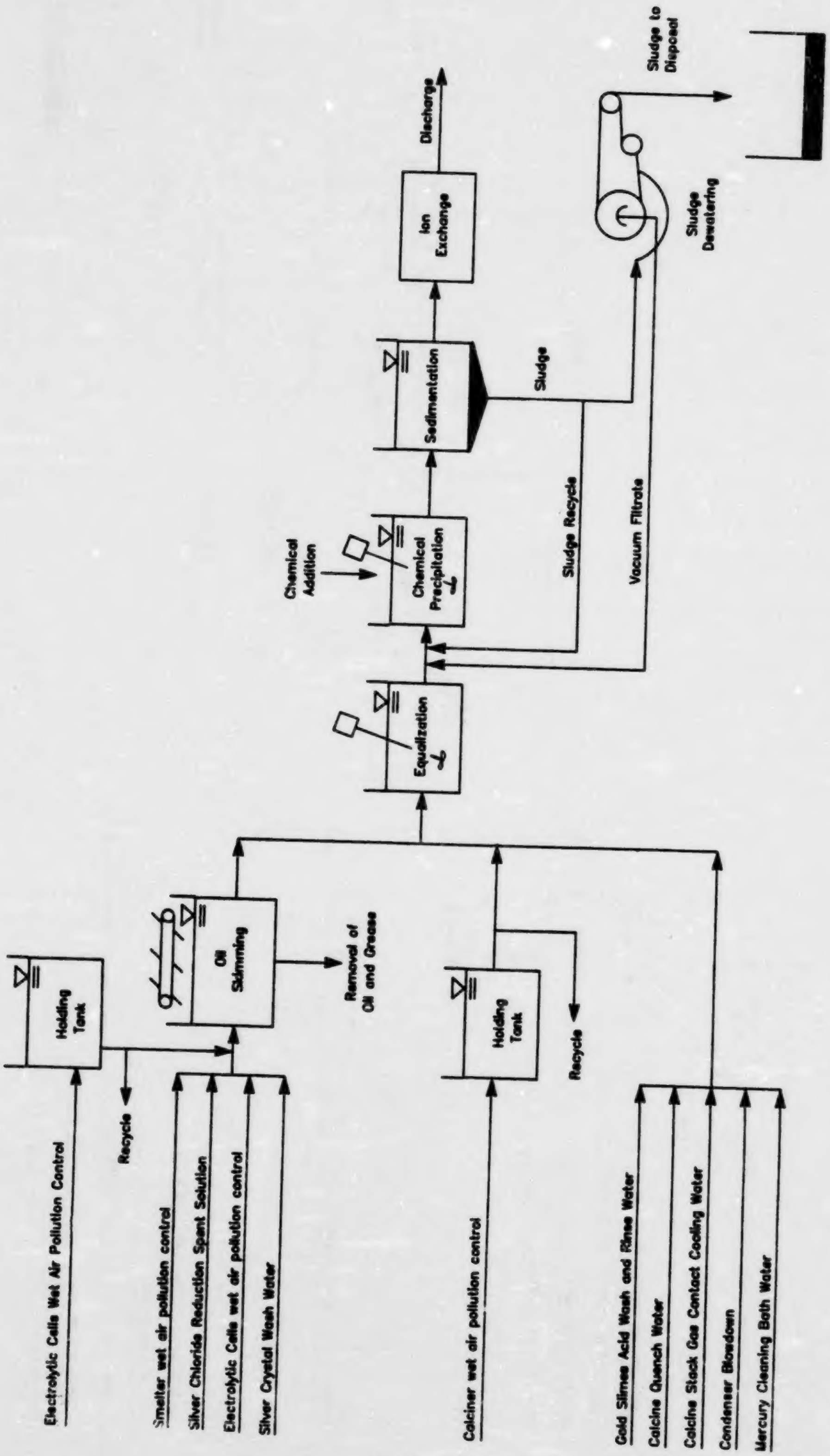
Electrolytic Cells Wet Air Pollution Control
Recycle
Holding Tank
Smelter wet air pollution control
Silver Chloride Reduction Spent Solution
Electrolytic Cells wet air pollution control
Silver Crystal Wash Water
Oil Skimming
Removal of Oil and Grease
Calciner wet air pollution control
Holding Tank
Recycle
Gold Slimes Acid Wash and Rinse Water
Calcine Quench Water
Calcine Stack Gas Contact Cooling Water
Condenser Blowdown
Mercury Cleaning Bath Water
Equalization
Chemical Addition
Chemical Precipitation
Sludge Recycle
Vacuum Filtrate
Sedimentation
Sludge
Ion Exchange
Discharge
Sludge Dewatering
Sludge to Disposal

FIGURE X-3 BAT TREATMENT SCHEME FOR OPTION C

SECTION XI

NEW SOURCE PERFORMANCE STANDARDS

This section describes the technologies for treatment of wastewater from new sources and presents mass discharge standards for regulated pollutants for NSPS in the primary precious metals and mercury subcategory, based on the selected treatment technology. The basis for new source performance standards (NSPS) is the best available demonstrated technology (BDT). New plants have the opportunity to design the best and most efficient production processes and wastewater treatment technologies without facing the added costs and restrictions encountered in retrofitting an existing plant. Therefore, EPA has considered the best demonstrated process changes, in-plant controls, and end-of-pipe treatment technologies which reduce pollution to the maximum extent feasible.

TECHNICAL APPROACH TO NSPS

New source performance standards are equivalent to the best available technology (BAT) selected for currently existing primary precious metals and mercury plants. This result is a consequence of careful review by the Agency of a wide range of technical options for new source treatment systems which is discussed in Section XI of Vol. I. Additionally, there was nothing found to indicate that the wastewater flows and characteristics of new plants would not be similar to those from existing plants, since the processes used by new sources are not expected to differ from those used at existing sources. Consequently, BAT production normalized discharge rates, which are based on the best existing practices of the subcategory, can also be applied to new sources. These rates are presented in Table XI-1 (page 2270).

Treatment technologies considered for the NSPS options are identical to the treatment technologies considered for the BAT options. These options are:

OPTION A

- Preliminary treatment with oil skimming (where required)
- Chemical precipitation and sedimentation
- Ion exchange

OPTION B

- Chemical precipitation and sedimentation
- In-process flow reduction of electrolytic cells and
- Calciner scrubber liquor

- Ion exchange

OPTION C

- Preliminary treatment with oil skimming (where required)
- Chemical precipitation and sedimentation
- In-process flow reduction of electrolytic cells and calciner scrubber liquor
- Multimedia filtration
- Ion exchange

NSPS OPTION SELECTION - PROPOSAL

EPA proposed that the best available demonstrated technology for the primary precious metals and mercury subcategory be equivalent to Option C (oil skimming preliminary treatment, flow reduction, chemical precipitation and sedimentation, and multimedia filtration).

The wastewater flow rates for NSPS were the same as the proposed BAT flow rates. Flow reduction measures for NSPS beyond the allowances for BAT were not considered feasible as no new demonstrated technologies existed within the subcategory. Therefore, EPA concluded that flow reduction beyond the allowances proposed for BAT were unachievable, and proposed NSPS flow rates should be equal to those for BAT.

NSPS OPTION SELECTION - PROMULGATION

EPA is promulgating best available technology for the primary precious metals and mercury subcategory equivalent to Option C (oil skimming preliminary treatment, flow reduction, chemical precipitation and sedimentation, ion exchange and multimedia filtration).

The wastewater flow rates for NSPS are the same as the BAT flow rates. The Agency does not believe that new plants could achieve any flow reduction beyond the allowances promulgated for BAT. Because NSPS is equal to BAT, the promulgated NSPS will not have a detrimental impact on the entry of new plants into this subcategory.

REGULATED POLLUTANT PARAMETERS

The Agency has no reason to believe that the pollutants that will be found in treatable concentrations in processes within new sources will be any different than with existing sources. Accordingly, pollutants and pollutant parameters selected for limitation under NSPS, in accordance with the rationale of Sections VI and X, are identical to those selected for BAT. The conventional pollutant parameters oil and grease, TSS, and pH are also selected for limitation.

NEW SOURCE PERFORMANCE STANDARDS

The NSPS discharge flows for each wastewater source are the same as the discharge rates for BAT and are shown in Table XI-1 (page 2270). The mass of pollutant allowed to be discharged per mass of product is calculated by multiplying the appropriate treatable concentration (mg/l) by the production normalized wastewater discharge flows (l/T.O. or l/kkg). The results of these calculations are the production-based new source performance standards. These standards are presented in Tables XI-2 (page 2271 - 2273).

Table XI-1

NSPS WASTEWATER DISCHARGE RATES FOR THE PRIMARY PRECIOUS METALS AND MERCURY SUBCATEGORY

Waste Stream	NSPS Discharge Rate (l/T.O. or l/kkg)	(gal/T.O. or gal/kkg)	PNP
1. Smelter wet air pollution control	1.3	0.343	troy ounce of gold and silver smelted
2. Silver chloride reduction spent solution	0.4	0.11	troy ounce of silver reduced in solution
3. Electrolytic cells wet air pollution control	19.8	5.23	troy ounce of gold refined electrolytically
4. Electrolyte preparation wet air pollution control	0.05	0.013	troy ounce of silver in electrolyte produced
5. Calciner wet air pollution control	22,000	5,812	kkg of mercury condensed
6. Calcine quench water	17,600	4,650	kkg of mercury condensed
7. Calciner stack gas contact cooling water	4,150	1,096	kkg of mercury condensed
8. Condenser blowdown	13,800	3,646	kkg of mercury condensed
9. Mercury cleaning bath water	1,400	370	kkg of mercury condensed

TABLE XI-2

NSPS FOR THE PRIMARY PRECIOUS METALS AND MERCURY SUBCATEGORY

(a) Smelter Wet Air Pollution Control NSPS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/troy ounce of gold and silver smelted		
Arsenic	1.807	0.806
Cadmium	0.260	0.104
Chromium	0.481	0.195
Copper	1.664	0.793
*Lead	0.364	0.169
*Mercury	0.195	0.078
Nickel	0.715	0.481
*Silver	0.377	0.156
Thallium	1.820	0.793
*Zinc	1.326	0.546
*Gold	0.130	---
*Oil and Grease	13.000	13.000
*TSS	19.500	15.600
*pH	Within the range of 7.5 to 10.0 at all times	

(b) Silver Chloride Reduction Spent Solution NSPS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/troy ounce of silver reduced in solution		
Arsenic	0.556	0.248
Cadmium	0.080	0.032
Chromium	0.148	0.060
Copper	0.512	0.244
*Lead	0.112	0.052
*Mercury	0.060	0.024
Nickel	0.220	0.148
*Silver	0.116	0.048
Thallium	0.560	0.244
*Zinc	0.408	0.168
*Gold	0.040	---
*Oil and Grease	4.000	4.000
*TSS	6.000	4.800
*pH	Within the range of 7.5 to 10.0 at all times	

*Regulated Pollutant

TABLE XI-2 (Continued)

NSPS FOR THE PRIMARY PRECIOUS METALS AND MERCURY SUBCATEGORY

(c) Electrolytic Cells Wet Air Pollution Control NSPS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/troy ounce of silver refined electrolytically		
Arsenic	27.520	12.280
Cadmium	3.960	1.584
Chromium	7.326	2.970
Copper	25.340	12.080
*Lead	5.544	2.574
*Mercury	2.970	1.188
Nickel	10.890	7.326
*Silver	5.742	2.376
Thallium	27.720	12.080
*Zinc	20.200	8.316
*Gold	1.980	---
*Oil and Grease	198.000	198.000
*TSS	297.000	237.600
*pH	Within the range of 7.5 to 10.0 at all times	

(d) Electrolyte Preparation Wet Air Pollution Control NSPS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/troy ounce of silver in electrolyte produced		
Arsenic	0.070	0.031
Cadmium	0.010	0.004
Chromium	0.019	0.008
Copper	0.064	0.031
*Lead	0.014	0.007
*Mercury	0.008	0.003
Nickel	0.028	0.019
*Silver	0.015	0.006
Thallium	0.070	0.031
*Zinc	0.051	0.021
*Gold	0.005	---
*Oil and Grease	0.500	0.500
*TSS	0.750	0.600
*pH	Within the range of 7.5 to 10.0 at all times	

*Regulated Pollutant

TABLE XI-2 (Continued)

NSPS FOR THE PRIMARY PRECIOUS METALS AND MERCURY SUBCATEGORY

(e) Calciner Wet Air Pollution Control NSPS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of mercury condensed		
Arsenic	30.580	13.640
Cadmium	4.400	1.760
Chromium	8.140	3.300
Copper	28.160	13.420
*Lead	6.160	2.860
*Mercury	3.300	1.320
Nickel	12.100	8.140
*Silver	6 380	2.640
Thallium	30.800	13.420
*Zinc	22.440	9.240
*Gold	2.200	.--
*Oil and Grease	220.000	220.000
*TSS	330.000	264.000
*pH	Within the range of 7.5 to 10.0 at all times	

(f) Calcine Quench Water NSPS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of mercury condensed		
Arsenic	24.460	10.910
Cadmium	3.520	1.408
Chromium	6.512	2.640
Copper	22.530	10.740
*Lead	4.928	2.288
*Mercury	2.640	1.056
Nickel	9.680	6.512
*Silver	5.104	2.112
Thallium	24.640	10.740
*Zinc	17.950	7.392
*Gold	1.760	---
*Oil and Grease	176.000	176.000
*TSS	264.000	211.200
*pH	Within the range of 7.5 to 10.0 at all times	

*Regulated Pollutant

TABLE XI-2 (Continued)

NSPS FOR THE PRIMARY PRECIOUS METALS AND MERCURY SUBCATEGORY

(g) Calciner Stack Gas Contact Cooling Water NSPS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of mercury condensed		
Arsenic	5.769	2.573
Cadmium	0.830	0.332
Chromium	1.536	0.623
Copper	5.312	2.532
*Lead	1.162	0.540
*Mercury	0.623	0.249
Nickel	2.283	1.536
*Silver	1.204	0.498
Thallium	5.810	2.532
*Zinc	4.233	1.743
*Gold	0.415	---
*Oil and Grease	41.500	41.500
*TSS	62.250	49.800
*pH	Within the range of 7.5 to 10.0 at all times	

(h) Condenser Blowdown NSPS

Pollutant or Pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of mercury condensed		
Arsenic	19.180	8.556
Cadmium	2.760	1.104
Chromium	5.106	2.070
Copper	17.660	8.418
*Lead	3.864	1.794
*Mercury	2.070	.828
Nickel	7.590	5.106
*Silver	4.002	1.656
Thallium	19.320	8.418
*Zinc	14.080	5.796
*Gold	1.380	---
*Oil and Grease	138.000	138.000
*TSS	207.000	165.600
*pH	Within the range of 7.5 to 10.0 at all times	

*Regulated Pollutant

TABLE XI-2 (Continued)

NSPS FOR THE PRIMARY PRECIOUS METALS AND MERCURY SUBCATEGORY

(i) Mercury Cleaning Bath Water NSPS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of mercury condensed		
Arsenic	1.946	0.868
Cadmium	0.280	0.112
Chromium	0.518	0.210
Copper	1.792	0.854
*Lead	0.392	0.182
*Mercury	0.210	0.084
Nickel	0.770	0.518
*Silver	0.406	0.168
Thallium	1.960	0.854
*Zinc	1.428	0.588
*Gold	0.140	---
*Oil and Grease	14.000	14.000
*TSS	21.000	16.800
*pH	Within the range of 7.5 to 10.0 at all times	

*Regulated Pollutant

SECTION XII

PRETREATMENT STANDARDS

This section describes the control and treatment technologies for pretreatment of process wastewaters from new sources in the primary precious metals and mercury subcategory. Pretreatment standards are designed to prevent the discharge of pollutants which pass through, interfere with, or are otherwise incompatible with the operation of publicly owned treatment works (POTW). The Clean Water Act requires pretreatment for pollutants, such as toxic metals, that limit POTW sludge management alternatives. New indirect discharge facilities, like new direct discharge facilities, have the opportunity to incorporate the best available demonstrated technologies, including process changes, in-plant controls, and end-of-pipe treatment technologies, and to use plant site selection to ensure adequate treatment system installation. Pretreatment standards are to be technology based, analogous to the best available or demonstrated technology for removal of toxic pollutants.

Pretreatment standards for regulated pollutants are presented based on the selected control and treatment technology. EPA is not promulgating pretreatment standards for existing sources in this subcategory because no indirect dischargers exist. Moreover, EPA is promulgating pretreatment standards for new sources because plants may be constructed in the future which may discharge to a POTW.

TECHNICAL APPROACH TO PRETREATMENT

Before proposing and promulgating pretreatment standards, the Agency examines whether the pollutants discharged by the industry pass through the POTW or interfere with the POTW operation or its chosen sludge disposal practices. In determining whether pollutants pass through a well-operated POTW achieving secondary treatment, the Agency compares the percentage of a pollutant removed by POTW with the percentage removed by direct dischargers applying the best available technology economically achievable. A pollutant is deemed to pass through the POTW when the average percentage removed nationwide by well-operated POTW meeting secondary treatment requirements, is less than the percentage removed by direct dischargers complying with BAT effluent limitations guidelines for that pollutant. (See generally, 46 FR at 9415-16 (January 28, 1981)).

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This definition of pass through satisfies two competing objectives set by Congress: (1) that standards for indirect dischargers be equivalent to standards for direct dischargers while at the same time, (2) that the treatment capability and performance of the POTW be recognized and taken into account in regulating the discharge of pollutants from indirect dischargers.

The Agency compares percentage removal rather than the mass or concentration of pollutants discharged because the latter would not take into account the mass of pollutants discharged to the POTW from non-industrial sources or the dilution of the pollutants in the POTW effluent to lower concentrations due to the addition of large amounts of non-industrial wastewater.

PRETREATMENT STANDARDS FOR NEW SOURCES

Options for pretreatment of wastewaters from new sources are based on increasing the effectiveness of end-of-pipe treatment technologies. All in-plant changes and applicable end-of-pipe treatment processes have been discussed previously in Sections X and XI. The options for PSNS are the same as the BAT and NSPS options discussed in Sections X and XI, respectively.

A description of each option is presented in Sections X and XI, while a more detailed discussion, including pollutants controlled by each treatment process is presented in Section VII of the General Development Document.

Treatment technologies considered for the PSNS options are:

OPTION A

- Preliminary treatment with oil skimming (where required)
- Chemical precipitation and sedimentation
- Ion exchange

OPTION B

- Preliminary treatment with oil skimming (where required)
- Chemical precipitation and sedimentation
- In-process flow reduction of electrolytic cells and calciner scrubber liquor
- Ion exchange

OPTION C

- Preliminary treatment with oil skimming (where required)
- Chemical precipitation and sedimentation
- In-process flow reduction of electrolytic cells and calciner scrubber liquor
- Multimedia filtration
- Ion exchange

PSNS OPTION SELECTION - PROPOSAL

EPA proposed that the technology basis of the pretreatment standards for new sources in the primary precious metals and mercury subcategory be equivalent to Option C (in-process flow reduction, oil skimming, chemical precipitation, sedimentation, and multimedia filtration).

The wastewater discharge rates for PSNS were equivalent to the proposed BAT discharge rates. No flow reduction measures for PSNS were considered feasible beyond the recycle proposed for BAT.

PSNS OPTION SELECTION - PROMULGATION

EPA has selected Option C (oil skimming, flow reduction, chemical precipitation and sedimentation, ion exchange and multimedia filtration) as the regulatory approach for pretreatment standards for new sources (PSNS). It is necessary to promulgate PSNS to prevent pass-through of lead, mercury, silver, and zinc. These toxic pollutants are removed by a well-operated POTW at an average of 62 percent, while BAT technology removes approximately 93 percent.

The wastewater discharge rates for promulgated PSNS are identical to the promulgated BAT discharge rates for each waste stream. The PSNS discharge rates are shown in Table XII-1 (page 2280). EPA does not believe that new plants could achieve flow reduction beyond the allowances promulgated for BAT.

We believe that the promulgated PSNS are achievable, and that they are not a barrier to entry of new plants into this subcategory.

REGULATED POLLUTANT PARAMETERS

Pollutants selected for limitation, in accordance with the rationale of Sections VI and X, are identical to those selected for limitation for BAT. It is necessary to promulgate PSNS to prevent the pass-through of lead, mercury, silver, and zinc.

PRETREATMENT STANDARDS

Pretreatment standards are based on the treatable concentrations from the selected treatment technology, (Option C), and the discharge rates determined in Sections X and XI for BAT and NSPS, respectively. These discharge rates are presented in Table XII-1 (page 2280). A mass of pollutant per mass of product (mg/troy ounce or mg/kilogram) allocation is given for each subdivision within the subcategory. This pollutant allocation is based on the product of the treatable concentration from the promulgated treatment (mg/l) and the production normalized wastewater discharge rate (l/troy ounce or l/kkg). The achievable treatment concentrations for BAT are identical to those for PSNS. PSNS are presented in Table XII-2 (page 2281).

Table XII-1

PSNS WASTEWATER DISCHARGE RATES FOR THE PRIMARY PRECIOUS METALS AND MERCURY SUBCATEGORY

Waste Stream	PSNS Discharge Rate (l/T.O. or l/kkg)	PSNS Discharge Rate (gal/T.O. or gal/kkg)	PNP
1. Smelter wet air pollution control	1.3		troy ounce of gold and silver smelted
2. Silver chloride reduction spent solution	0.4		troy ounce of gold reduced in solution
3. Electrolytic cells wet air pollution control	19.8		troy ounce of gold refined electrolytically
4. Electrolyte preparation wet air pollution control	0.05		troy ounce of gold in electrolyte produced
5. Calciner wet air pollution control	22,000		kkg of mercury condensed
6. Calcine quench water	17,600		kkg of mercury condensed
7. Calciner stack gas contact cooling water	4,150		kkg of mercury condensed
8. Condenser blowdown	13,800		kkg of mercury condensed
9. Mercury cleaning bath water	1,400		kkg of mercury condensed

TABLE XII-2

PSNS FOR THE PRIMARY PRECIOUS METALS AND MERCURY SUBCATEGORY

(a) Smelter Wet Air Pollution Control PSNS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/troy ounce of gold and silver smelted		
Arsenic	1.807	0.806
Cadmium	0.260	0.104
Chromium	0.481	0.195
Copper	1.664	0.793
*Lead	0.364	0.169
*Mercury	0.195	0.078
Nickel	0.715	0.481
*Silver	0.377	0.156
Thallium	1.820	0.793
*Zinc	1.326	0.546
*Gold	0.130	---

(b) Silver Chloride Reduction Spent Solution PSNS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/troy ounce of silver reduced in solution		
Arsenic	0.556	0.248
Cadmium	0.080	0.032
Chromium	0.148	0.060
Copper	0.512	0.244
*Lead	0.112	0.052
*Mercury	0.060	0.024
Nickel	0.220	0.148
*Silver	0.116	0.048
Thallium	0.560	0.244
*Zinc	0.408	0.168
*Gold	0.040	---

*Regulated Pollutant

TABLE XII-2 (Continued)

PSNS FOR THE PRIMARY PRECIOUS METALS AND MERCURY SUBCATEGORY

(c) Electrolytic Cells Wet Air Pollution Control PSNS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/troy ounce of silver refined electrolytically		
Arsenic	27.520	12.280
Cadmium	3.960	1.584
Chromium	7.326	2.970
Copper	25.340	12.080
*Lead	5.544	2.574
*Mercury	2.970	1.188
Nickel	10.890	7.326
*Silver	5.742	2.376
Thallium	27.720	12.080
*Zinc	20.200	8.316
*Gold	1.980	---

(d) Electrolyte Preparation Wet Air Pollution Control PSNS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/troy ounce of silver in electrolyte produced		
Arsenic	0.070	0.031
Cadmium	0.010	0.004
Chromium	0.019	0.008
Copper	0.064	0.031
*Lead	0.014	0.007
*Mercury	0.008	0.003
Nickel	0.028	0.019
*Silver	0.015	0.006
Thallium	0.070	0.031
*Zinc	0.051	0.021
*Gold	0.005	---

*Regulated Pollutant

TABLE XII-2 (Continued)

PSNS FOR THE PRIMARY PRECIOUS METALS AND MERCURY SUBCATEGORY

(e) Calciner Wet Air Pollution Control PSNS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of mercury condensed		
Arsenic	30.580	13.640
Cadmium	4.400	1.760
Chromium	8.140	3.300
Copper	28.160	13.420
*Lead	6.160	2.860
*Mercury	3.300	1.320
Nickel	12.100	8.140
*Silver	6.380	2.640
Thallium	30.800	13.420
*Zinc	22.440	9.240
*Gold	2.200	---

(f) Calcine Quench Water PSNS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of mercury condensed		
Arsenic	24.460	10.910
Cadmium	3.520	1.408
Chromium	6.512	2.640
Copper	22.530	10.740
*Lead	4.928	2.288
*Mercury	2.640	1.056
Nickel	9.680	6.512
*Silver	5.104	2.112
Thallium	24.640	10.740
*Zinc	17.950	7.392
*Gold	1.760	---

*Regulated Pollutant

TABLE XII-2 (Continued)

PSNS FOR THE PRIMARY PRECIOUS METALS AND MERCURY SUBCATEGORY

(g) Calciner Stack Gas Contact Cooling Water PSNS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of mercury condensed		
Arsenic	5.769	2.573
Cadmium	0.830	0.332
Chromium	1.536	0.623
Copper	5.312	2.532
*Lead	1.162	0.540
*Mercury	0.623	0.249
Nickel	2.283	1.536
*Silver	1.204	0.498
Thallium	5.810	2.532
*Zinc	4.233	1.743
*Gold	0.415	---

(h) Condenser Blowdown PSNS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of mercury condensed		
Arsenic	19.180	8.556
Cadmium	2.760	1.104
Chromium	5.106	2.070
Copper	17.660	8.418
*Lead	3.864	1.794
*Mercury	2.070	0.828
Nickel	7.590	5.106
*Silver	4.002	1.656
Thallium	19.320	8.418
*Zinc	14.080	5.796
*Gold	1.380	---

*Regulated Pollutant

TABLE XII-2 (Continued)

PSNS FOR THE PRIMARY PRECIOUS METALS AND MERCURY SUBCATEGORY

(i) Mercury Cleaning Bath Water

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of mercury condensed		
Arsenic	1.946	0.868
Cadmium	0.280	0.112
Chromium	0.518	0.210
Copper	1.792	0.854
*Lead	0.392	0.182
*Mercury	0.210	0.084
Nickel	0.770	0.518
*Silver	0.406	0.168
Thallium	1.960	0.854
*Zinc	1.428	0.588
*Gold	0.140	---

*Regulated Pollutant

SECTION XIII

BEST CONVENTIONAL POLLUTANT CONTROL TECHNOLOGY

EPA is not promulgating best conventional pollutant control technology (BCT) for the primary precious metals and mercury subcategory at this time.

NONFERROUS METALS MANUFACTURING POINT SOURCE CATEGORY

DEVELOPMENT DOCUMENT SUPPLEMENT

for the

Secondary Precious Metals Subcategory

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SECTION I

SUMMARY

This document provides the technical basis for promulgating effluent limitations based on best practicable technology (BPT) and best available technology (BAT) for existing direct dischargers, pretreatment standards for existing indirect dischargers (PSES), pretreatment standards for new indirect dischargers (PSNS), and standards of performance for new source direct dischargers (NSPS).

After promulgation of the second phase of the nonferrous metals manufacturing regulation, petitioners asked the Courts to review the final rule. After reviewing the petitioners complaints, the Agency and petitioners developed a settlement agreement resolving the complaints raised about the secondary precious metals subcategory. In this agreement, the Agency agreed to propose certain changes to the regulation of this subcategory. These amendments were published proposed on April 28, 1989 (54 FR 18412). Details of these amendments are found at that reference and the proposed changes have been incorporated into this document.

The secondary precious metals subcategory is comprised of 49 plants. Of the 49 plants, four discharge directly to rivers, lakes, or streams; 30 discharge to publicly owned treatment works (POTW); and 15 achieve zero discharge of process wastewater.

EPA first studied the secondary precious metals subcategory to determine whether differences in raw materials, final products, manufacturing processes, equipment, age and size of plants, or water usage, required the development of separate effluent limitations and standards for different segments of the subcategory. This involved a detailed analysis of wastewater discharge and treated effluent characteristics, including the sources and volume of water used, the processes used, the sources of pollutants and wastewaters in the plant, and the constituents of wastewaters, including toxic pollutants. As a result, 14 subdivisions or building blocks have been identified for this subcategory that warrant separate effluent limitations. These include:

1. Furnace wet air pollution control,
2. Raw material granulation,
3. Spent plating solutions,
4. Spent cyanide stripping solutions,
5. Refinery wet air pollution control,
6. Gold solvent extraction raffinate and wash water,
7. Gold spent electrolyte,
8. Gold precipitation and filtration,
9. Platinum precipitation and filtration,
10. Palladium precipitation and filtration,

11. Other platinum group metals (PGM) precipitation and filtration,
12. Spent solution from PGC salt production,
13. Equipment and floor wash, and
14. Preliminary treatment.

Several distinct control and treatment technologies (both in-plant and end-of-pipe) applicable to the secondary precious metals subcategory were identified. The Agency analyzed both historical and newly generated data on the performance of these technologies, including their nonwater quality environmental impacts and air quality, solid waste generation, and energy requirements. EPA also studied various flow reduction techniques reported in the data collection portfolios (dcp) and plant visits.

Engineering costs were prepared for each of the control and treatment options considered for the subcategory. These costs were then used by the Agency to estimate the impact of implementing the various options on the subcategory. For each control and treatment option that the Agency found to be most effective and technically feasible in controlling the discharge of pollutants, the number of potential closures, number of employees affected, and impact on price were estimated. These results are reported in a separate document entitled "The Economic Impact Analysis of Effluent Limitations and Standards for the Nonferrous Metals Manufacturing Industry."

After examining the various treatment technologies, the Agency has identified BPT to represent the average of the best existing technology. Metals removal based on chemical precipitation and sedimentation technology is the basis for the BPT limitations. Steam stripping was selected as the technology basis for ammonia limitations. Cyanide precipitation was selected as the technology basis for cyanide limitations. Ion exchange was selected as the basis for gold, platinum and palladium limitations. To meet the BPT effluent limitations based on this technology, the secondary precious metals subcategory is expected to incur a capital and annual cost. These costs cannot be disclosed because the data on which they are based have been claimed to be confidential.

For BAT, the Agency has built upon the BPT technology basis by adding in-process control technologies which include recycle of process water from air pollution control waste streams and recycle of raw material granulation water. Filtration is added as an effluent polishing step to the end-of-pipe treatment scheme prior to ion exchange. To meet the BAT effluent limitations based on this technology, the secondary precious metals subcategory is expected to incur a capital and annual cost. These costs cannot be disclosed because publication of the costs could reveal the data on which they are based. These data have been claimed confidential.

NSPS is equivalent to BAT. In selecting NSPS, EPA recognizes that new plants have the opportunity to implement the best and most efficient manufacturing processes and treatment technology. As such, the technology basis of BAT has been determined as the best demonstrated technology.

The technology basis for PSES is equivalent to BAT. To meet the pretreatment standards for existing sources, the secondary precious metals subcategory is estimated to incur a capital cost of $1,809,400 and an annual cost of $1,100,500. For PSNS, the Agency selected end-of-pipe treatment and in-process flow reduction control techniques equivalent to NSPS.

Based on comments received after proposal, the Agency believes that it may be necessary for some facilities to use sulfide polishing in order to achieve the promulgated effluent limitations because of high zinc concentrations or complexing problems. Because the Agency believes that these situations will be the exception, rather than the rule, sulfide polishing is not specifically included as part of the model technology on which effluent limitations and performance standards are based. The Agency has, however, evaluated the cost associated with the use of sulfide polishing at secondary precious metals plants. After performing this evaluation, the Agency has concluded that sulfide polishing will result in a very small (less than 5 percent) incremental increase in wastewater treatment costs at a typical secondary precious metals facility.

The best conventional technology (BCT) replaces BAT for the control of conventional pollutants. BCT is not being promulgated because the methodology for BCT has not yet been finalized.

The mass limitations and standards for BPT, BAT, NSPS, PSES, and PSNS are presented in Section II.

SECTION II

CONCLUSIONS

EPA has divided the secondary precious metals subcategory into 14 subdivisions or building blocks for the purpose of effluent limitations and standards. These building blocks are:

1. Furnace wet air pollution control,
2. Raw material granulation,
3. Spent plating solutions,
4. Spent cyanide stripping solutions,
5. Refinery wet air pollution control,
6. Gold solvent extraction raffinate and washwater,
7. Gold spent electrolyte,
8. Gold precipitation and filtration,
9. Platinum precipitation and filtration,
10. Palladium precipitation and filtration,
11. Other platinum group metals precipitation and filtration,
12. Spent solution from PGC salt production,
13. Equipment and floor wash, and
14. Preliminary treatment.

BPT is promulgated based on the performance achievable by the application of chemical precipitation and sedimentation (lime and settle) technology, and ion exchange end-of-pipe treatment, along with preliminary treatment consisting of ammonia steam stripping and cyanide precipitation for selected waste streams. The following BPT effluent limitations are promulgated:

(a) Furnace Wet Air Pollution Control BPT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of precious metals, including silver, incinerated or smelted		
Copper	136.400	71.800
Cyanide (total)	20.820	8.616
Zinc	104.800	43.800
Ammonia (as N)	9,571.000	4,207.000
Combined metals	21.54	
Total suspended solids	2,944.000	1,400.000
pH	Within the range of 7.5 to 10.0 at all times	

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(b) Raw Material Granulation BPT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of precious metal in the granulated raw material		
Copper	12.050	6.340
Cyanide (total)	1.839	0.761
Zinc	9.256	3.867
Ammonia (as N)	845.100	371.500
Combined metals	1.903	----
Total suspended solids	259.900	123.600
pH	Within the range of 7.5 to 10.0 at all times	

(c) Spent Plating Solutions BPT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/liter of spent plating solution used as a raw material		
Copper	1.900	1.000
Cyanide (total)	0.290	0.120
Zinc	1.460	0.610
Ammonia (as N)	133.300	58.600
Combined metals	0.300	
Total suspended solids	41.000	19.500
pH	Within the range of 7.5 to 10.0 at all times	

(d) Spent Cyanide Stripping Solutions BPT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of gold produced by cyanide stripping		
Copper	7.030	3.700
Cyanide (total)	1.073	0.444
Zinc	5.402	2.257
Ammonia (as N)	493.200	216.800
Combined metals	1.110	----
Total suspended solids	151.700	72.150
pH	Within the range of 7.5 to 10.0 at all times	

(e) Refinery Wet Air Pollution Control[1] BPT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of precious metals, including silver, produced in refinery		
Copper	39.900	21.000
Cyanide (total)	6.090	2.520
Zinc	30.660	12.810
Ammonia (as N)	2,799.000	1,231.000
Combined metals	6.300	
Total suspended solids	861.000	409.500
pH	Within the range of 7.5 to 10.0 at all times	

[1] This allowance applies to either acid or alkaline wet air pollution control scrubbers. If both acid and alkaline wet air pollution control scrubbers are present in a particular facility the same allowance applies to each.

(f) Gold Solvent Extraction Raffinate and Wash Water BPT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of gold produced by solvent extraction		
Copper	1.197	0.630
Cyanide (total)	0.183	0.076
Zinc	0.920	0.38?
Ammonia (as N)	83.980	36.920
Combined metals	0.189	----
Total suspended solids	25.830	12.290
pH	Within the range of 7.5 to 10.0 at all times	

(g) Gold Spent Electrolyte BPT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of gold produced by electrolysis		
Copper	0.017	0.009
Cyanide (total)	0.003	0.001
Zinc	0.013	0.005
Ammonia (as N)	1.160	0.510
Combined metals	0.003	
Total suspended solids	0.357	0.170
pH	Within the range of 7.5 to 10.0 at all times	

(h) Gold Precipitation and Filtration BPT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of gold precipitated		
Copper	8.360	4.400
Cyanide (total)	1.276	0.528
Zinc	6.242	2.684
Ammonia (as N)	586.500	257.800
Combined metals	1.320	----
Total suspended solids	180.400	85.800
pH	Within the range of 7.5 to 10.0 at all times	

(i) Platinum Precipitation and Filtration BPT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of platinum precipitated		
Copper	9.880	5.200
Cyanide (total)	1.508	0.624
Zinc	7.592	3.172
Ammonia (as N)	693.200	304.700
Combined metals		----
Total suspended solids	213.200	101.400
pH	Within the range of 7.5 to 10.0 at all times	

(j) Palladium Precipitation and Filtration BPT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of palladium precipitated		
Copper	11.400	6.000
Cyanide (total)	1.740	0.720
Zinc	8.760	3.660
Ammonia (as N)	799.800	351.600
Combined metals	1.800	----
Total suspended solids	246.0	117.000
pH	Within the range of 7.5 to 10.0 at all times	

(k) Other Platinum Group Metals Precipitation and Filtration BPT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of other platinum group metals precipitated		
Copper	9.880	5.200
Cyanide (total)	1.508	0.624
Zinc	7.592	3.172
Ammonia (as N)	693.200	304.700
Combined metals	1.560	----
Total suspended solids	213.200	101.400
pH	Within the range of 7.5 to 10.0 at all times	

(l) Spent Solution from PGC Salt Production BPT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of gold contained in PGC product		
Copper	1.710	0.900
Cyanide (total)	0.261	0.108
Zinc	1.314	0.549
Ammonia (as N)	120.000	52.740
Combined metals	0.270	----
Total suspended solids	36.900	17.550
pH	Within the range of 7.5 to 10.0 at all times	

(m) Equipment and Floor Wash BPT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of precious metals, including silver, produced in refinery		
Copper	0 000	0 000
Cyanide (total)	0.000	0.000
Zinc	0.000	0.000
Ammonia (as N)	0.000	0.000
Combined metals	0.000	
Total suspended solids	0.000	0.000
pH	Within the range of 7.5 to 10.0 at all times	

(n) Preliminary treatment BPT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of precious metals produced in refinery		
Copper	95.000	50.000
Cyanide (total)	14.500	6.000
Zinc	73.000	30.500
Ammonia (as N)	6665.000	2930.000
Combined metals	15.000	---
Total suspended solids	2050.000	975.000
pH	Within the range of 7.5 to 10.0 at all times	

BAT is promulgated based on the performance achievable by the application of chemical precipitation, sedimentation, and multimedia filtration (lime, settle, and filter) technology, ion exchange end-of-pipe treatment, and in-process flow reduction methods, along with preliminary treatment consisting of ammonia steam stripping and cyanide precipitation for selected waste streams. The following BAT effluent limitations are promulgated:

(a) Furnace Wet Air Pollution Control BAT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of precious metals, including silver, incinerated or smelted		
Copper	5.760	2.745
Cyanide (total)	0.900	0.360
Zinc	4.590	1.890
Ammonia (as N)	599.900	263.700
Combined metals	1.350	----

(b) Raw Material Granulation BAT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of precious metals in in the granulated raw material		
Copper	0.819	0.390
Cyanide (total)	0.128	0.051
Zinc	0.653	0.269
Ammonia (as N)	85.310	37.500
Combined metals	0.192	----

(c) Spent Plating Solutions BAT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/liter of spent plating solution used as a raw material		
Copper	1.280	0.610
Cyanide (total)	0.200	0.080
Zinc	1.020	0 420
Ammonia (as N)	133.300	58.600
Combined metals	0.300	----

(d) Spent Cyanide Stripping Solutions BAT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of gold produced by cyanide stripping		
Copper	4.736	2.257
Cyanide (total)	0.740	0.296
Zinc	3.774	1.554
Ammonia (as N)	493.200	216.800
Combined metals	1.110	----

(e) Refinery Wet Air Pollution Control[1] BAT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of precious metals, including silver, produced in refinery		
Copper	1 280	0.610
Cyanide (total)	0.200	0.080
Zinc	1 020	0.420
Ammonia (as N)	133.300	58.600
Combined metals	0.300	----

[1] This allowance applies to either acid or alkaline wet air pollution control scrubbers. If both acid and alkaline wet air pollution control scrubbers are present in a particular facility the same allowance applies to each.

(f) Gold Solvent Extraction Raffinate and Wash Water

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of gold produced by solvent extraction		
Copper	0.806	0.384
Cyanide (total)	0.126	0.050
Zinc	0.6?3	0.265
Ammonia (as N)	83.980	36.920
Combined metals	0.189	----

(g) Gold Spent Electrolyte BAT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of gold produced by electrolysis		
Copper	0.011	0.005
Cyanide (total)	0.002	0.001
Zinc	0.009	0.004
Ammonia (as N)	1.160	0 510
Combined metals	0.003	

(h) Gold Precipitation and Filtration BAT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of gold precipitated		
Copper	5.632	2.684
Cyanide (total)	0.880	0.352
Zinc	4.488	1.848
Ammonia (as N)	586.500	257.800
Combined metals	1.320	----

(i) Platinum Precipitation and Filtration BAT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of platinum precipitated		
Copper	6.656	3.172
Cyanide (total)	1.040	0.416
Zinc	5.304	2.184
Ammonia (as N)	693.200	304.700 Combined metals
1.560		

(j) Palladium Precipitation and Filtration BAT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of palladium precipitated		
Copper	7.680	3.660
Cyanide (total)	1.200	0.480
Zinc	6.120	2.520
Ammonia (as N)	799.800	351.600
Combined metals	1.800	----

(k) Other Platinum Group Metals Precipitation and Filtration BAT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of other platinum group metals precipitated		
Copper	6.656	3.172
Cyanide (total)	1.040	0.416
Zinc	5.304	2.184
Ammonia (as N)	693.200	304.700
Combined metals	1.560	----

(l) Spent Solution from PGC Salt Production BAT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of gold contained in PGC product		
Copper	1.152	0.549
Cyanide (total)	0.180	0.072
Zinc	0.918	0.378
Ammonia (as N)	120.000	52.740
Combined metals	0.270	

(m) Equipment and Floor Wash BAT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of precious metals, including silver, produced in refinery		
Copper	0.000	0.000
Cyanide (total)	0.000	0.000
Zinc	0.000	0 000
Ammonia (as N)	0.000	0.000
Combined metals	0.000	----

(n) Preliminary treatment BAT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of total precious metals produced through this operation		
Copper	64.000	30.500
Cyanide (total)	10.000	4.000
Zinc	51.000	21.000
Combined metals	15.000	--
Ammonia (as N).	6665.000	2930.000

NSPS are promulgated based on the performance achievable by the application of chemical precipitation, sedimentation, and multimedia filtration (lime, settle, and filter) technology, ion exchange end-of-pipe treatment, and in-process flow reduction control methods, along with preliminary treatment consisting of ammonia steam stripping and cyanide precipitation for selected waste streams. The following effluent standards are promulgated for new sources:

(a) Furnace Wet Air Pollution Control NSPS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of precious metals, including silver, incinerated or smelted		
Copper	5.760	2.745
Cyanide (total)	0.900	0.360
Zinc	4.590	1.890
Ammonia (as N)	599.900	263.700
Combined metals	1.350	----
Total suspended solids	67.500	54.000
pH	Within the range of 7.5 to 10.0 at all times	

(b) Raw Material Granulation NSPS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of precious metals in the granulated raw material		
Copper	0.819	0.390
Cyanide (total)	0.128	0.051
Zinc	0.653	0.269
Ammonia (as N)	85.310	37.500
Combined metals	0.192	----
Total suspended solids	9.600	7.680
pH	Within the range of 7.5 to 10.0 at all times	

(c) Spent Plating Solutions NSPS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/liter of spent plating solution used as a raw material		
Copper	1.280	0.610
Cyanide (total)	0.200	0.080
Zinc	1.020	0.420
Ammonia (as N)	133.300	58.600
Combined metals	0.300	----
Total suspended solids	15.000	12.000
pH	Within the range of 7.5 to 10.0 at all times	

(d) Spent Cyanide Stripping Solutions NSPS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of gold produced by cyanide stripping		
Copper	4.736	2.257
Cyanide (total)	0.740	0.296
Zinc	3.774	1.554
Ammonia (as N)	493.200	216.800
Combined metals	1.110	----
Total suspended solids	55.500	44.400
pH	Within the range of 7.5 to 10.0 at all times	

(e) Refinery Wet Air Pollution Control[1] NSPS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of precious metals, including silver, produced in refinery		
Copper	1.280	0.610
Cyanide (total)	0.200	0.080
Zinc	1.020	0.420
Ammonia (as N)	133.300	58.600
Combined metals	0.300	----
Total suspended solids	15.000	12.000
pH	Within the range of 7.5 to 10.0 at all times	

---

[1] This allowance applies to either acid or alkaline wet air pollution control scrubbers. If both acid and alkaline wet air pollution control scrubbers are present in a particular facility the same allowance applies to each.

(f) old Solvent Extraction Raffinate and Wash Water NSPS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of gold produced by solvent extraction		
Copper	0.806	0.384
Cyanide (total)	0.126	0.050
Zinc	0.643	0.265
Ammonia (as N)	83.980	36.920
Combined metals	0.189	----
Total suspended solids	9.450	7.560
pH	Within the range of 7.5 to 10.0	
at	all times	

(g) Gold Spent Electrolyte NSPS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of gold produced by electrolysis		
Copper	0.011	0.005
Cyanide (total)	0.002	0.001
Zinc	0.009	0.004
Ammonia (as N)	1.160	0.510
Combined metals	0.003	
Total suspended solids	0.131	0.104
pH	Within the range of 7.5 to 10.0 at all times	

(h) Gold Precipitation and Filtration NSPS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of gold precipitated		
Copper	5.632	2.684
Cyanide (total)	0.880	0.352
Zinc	4.488	1.848
Ammonia (as N)	586.500	257.800
Combined metals	1.320	
Total suspended solids	66.000	52.800
pH	Within the range of 7.5 to 10.0 at all times	

(i) Platinum Precipitation and Filtration NSPS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of platinum precipitated		
Copper	6.656	3.172
Cyanide (total)	1.040	0.416
Zinc	5 304	2.184
Ammonia (as N)	693.200	304.700
Combined metals	1.560	
Total suspended solids	78.000	62.400
pH	Within the range of 7.5 to 10.0 at all times	

(J) Palladium Precipitation and Filtration NSPS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of palladium precipitated		
Copper	7.680	3.660
Cyanide (total)	1.200	0.480
Zinc	6.120	2.520
Ammonia (as N)	799.800	351.600
Combined metals	1.800	
Total suspended solids	90.000	72.000
pH	Within the range of 7.5 to 10.0 at all times	

(k) Other Platinum Group Metals Precipitation and Filtration NSPS

Pollutant or Property	Maximum for Any One Day	Maximum for Pollutant Monthly Average
mg/troy ounce of other platinum group metals precipitated		
Copper	6.656	3.172
Cyanide (total)	1.040	0.416
Zinc	5.304	2.184
Ammonia (as N)	693.200	30?.700
Combined metals	1.560	----
Total suspended solids	78.000	62.400
pH	Within the range of 7.5 to 10.0 at all times	

(l) Spent Solutions from PGC Salt Production NSPS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of gold contained in PGC product		
Copper	1.152	0.549
Cyanide (total)	0.180	0.072
Zinc	0.918	0.378
Ammonia (as N)	120.000	52.740
Combined metals	0.270	----
Total suspended solids	13.500	10.800
pH	Within the range of 7.5 to 10.0 at all times	

(m) Equipment and Floor Wash NSPS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of precious metals, including silver, produced in refinery		
Copper	0.000	0.000
Cyanide (total)	0.000	0.000
Zinc	0.000	0.000
Ammonia (as N)	0.000	0.000
Combined metals	0.000	
Total suspended solids	0.000	0.000
pH	Within the range of 7.5 to 10.0 at all times	

(n) Preliminary treatment NSPS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of total precious metals produced through this operation		
Copper	64.000	30.500
Cyanide (total)	10.000	4.000
Zinc	51.000	21.000
Combined metals	15.000	--
Ammonia (as N)	6665.000	2930.000
Total suspended solids	750.000	600.000
pH	Within the range of 7.5 to 10.0 at all times	

PSES are promulgated based on the performance achievable by the application of chemical precipitation, sedimentation, and multimedia filtration (lime, settle, and filter) technology, ion exchange end-of-pipe treatment, and in-process flow reduction control methods, along with preliminary treatment consisting of ammonia steam stripping and cyanide precipitation for selected waste streams. The following pretreatment standards are promulgated for existing sources:

(a) Furnace Wet Air Pollution Control PSES

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of precious metals, including silver, incinerated or smelted		
Copper	5.760	2.745
Cyanide (total)	0.900	0.360
Zinc	4.590	1.890
Ammonia (as N)	599.900	263.700
Combined metals	1.350	----

(b) Raw Material Granulation PSES

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of precious metals in the granulated raw material		
Copper	0.819	0.390
Cyanide (total)	0.128	0.051
Zinc	0.653	0.269
Ammonia (as N)	85.310	37.500
Combined metals	0.192	----

(c) Spent Plating Solutions PSES

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/liter of spent plating solution used as a raw material		
Copper	1.280	0.610
Cyanide (total)	0.200	0.080
Zinc	1.020	0.420
Ammonia (as N)	133.300	58.600
Combined metals	0.300	----

(d) Spent Cyanide Stripping Solutions PSES

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of gold produced by cyanide stripping		
Copper	4.736	2.257
Cyanide (total)	0.740	0.296
Zinc	3.774	1.554
Ammonia (as N)	493.200	216.800
Combined metals	1.110	----

(e) Refinery Wet Air Pollution Control[1] PSES

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of precious metals, including silver, produced in refinery		
Copper	1.280	0.610
Cyanide (total)	0.200	0.080
Zinc	1.020	0.420
Ammonia (as N)	133.300	58.600
Combined metals	0.300	----

[1] This allowance applies to either acid or alkaline wet air pollution control scrubbers. If both acid and alkaline wet air pollution control scrubbers are present in a particular facility the same allowance applies to each.

(f) Gold Solvent Extraction Raffinate and Wash Water PSES

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of gold produced by solvent extraction		
Copper	0.806	0.384
Cyanide (total)	0.126	0.050
Zinc	0.643	0.265
Ammonia (as N)	83.980	36.920
Combined metals	0.189	----

(g) Gold Spent Electrolyte PSES

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of gold produced by electrolysis		
Copper	0.011	0.005
Cyanide (total)	0.002	0.001
Zinc	0.009	0.004
Ammonia (as N)	1.160	0.510
Combined metals	0.003	----

(h) Gold Precipitation and Filtration PSES

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of gold precipitated		
Copper	5.632	2.684
Cyanide (total)	0.880	0.352
Zinc	4.488	1.848
Ammonia (as N)	586.500	257.800
Combined metals	1.320	----

(i) Platinum Precipitation and Filtration PSES

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of platinum precipitated		
Copper	6.656	3.172
Cyanide (total)	1.040	0.416
Zinc	5.304	2.184
Ammonia (as N)	693.200	304.700
Combined metals	1.560	----

(j) Palladium Precipitation and Filtration PSES

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of palladium precipitated		
Copper	7.680	3.660
Cyanide (total)	1.200	0.480
Zinc	6.120	2.520
Ammonia (as N)	799.800	351.600
Combined metals	1.800	----

(k) Other Platinum Group Metals Precipitation and Filtration PSES

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of other platinum group metals precipitated		
Copper	6.656	3.172
Cyanide (total)	1.040	0.416
Zinc	5.304	2.184
Ammonia (as N)	693.200	304.700
Combined metals	1.560	----

(l) Spent Solution from PGC Salt Production PSES

Pollutant or Property	Maximum for Any One Day	Maximum for Pollutant Monthly Average
mg/troy ounce of gold contained in PGC product		
Copper	1.152	0.549
Cyanide (total)	0.180	0.072
Zinc	0.918	0.378
Ammonia (as N)	120.000	52.740
Combined metals	0.270	----

(m) Equipment and Floor Wash PSES

Pollutant or Pollutant ProPerty	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of precious metals, including silver, produced in refinery		
Copper	0.000	0.000
Cyanide (total)	0.000	0.000
Zinc	0.000	0.000
Ammonia (as N)	0.000	0.000
Combined metals	0.000	----

(n) Preliminary treatment PSES

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of total precious metals produced through this operation		
Copper	64.000	30.500
Cyanide (total)	10.000	4.000
Zinc	51.000	21.000
Combined metals	15.000	--
Ammonia (as N)	6665.000	2930.000

PSNS are promulgated based on the performance achievable by the application of chemical precipitation, sedimentation, and multimedia filtration (lime, settle, and filter) technology, ion exchange end-of-pipe treatment, and in-process flow reduction control methods, along with preliminary treatment consisting of ammonia steam stripping and cyanide precipitation for selected waste streams. The following pretreatment standards are promulgated for new sources:

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Copper	5.760	2.745
Cyanide (total)	0.900	0.360
Zinc	4.590	1.890
Ammonia (as N)	599.900	263.700
Combined metals	1.350	----

(b) Raw Material Granulation PSNS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of precious metals in the granulated raw material		
Copper	0.819	0.390
Cyanide (total)	0.128	0.051
Zinc	0.654	0.269
Ammonia (as N)	85.310	37.500
Combined metals	0.192	----

(c) Spent Plating Solutions PSNS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/liter of spent plating solution used as a raw material		
Copper	1.280	0.610
Cyanide (total)	0.200	0.080
Zinc	1.020	0.420
Ammonia (as N)	133.300	58.600
Combined metals	0.300	----

(d) Spent Cyanide Stripping Solutions PSNS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of gold produced by cyanide stripping		
Copper	4.736	2.257
Cyanide (total)	0.740	0.296
Zinc	3.774	1.554
Ammonia (as N)	493.200	216.800
Combined metals	1.110	

(e) Refinery Wet Air Pollution Control[1] PSNS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of precious metals, including silver, produced in refinery		
Copper	1.280	0.610
Cyanide (total)	0.200	0.080
Zinc	1.020	0.420
Ammonia (as N)	133.300	58.600
Combined metals	0.300	----

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[1] This allowance applies to either acid or alkaline wet air pollution control scrubbers. If both acid and alkaline wet air pollution control scrubbers are present in a particular facility the same allowance applies to each.

(f) Gold Solvent Extraction Raffinate and Wash Water PSNS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of gold produced by solvent extraction		
Copper	0.806	0.384
Cyanide (total)	0.126	0.050
Zinc	0.643	0.265
Ammonia (as N)	83.980	36.920
Combined metals	0.189	

(g) Gold Spent Electrolyte PSNS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of gold produced by electrolysis		
Copper	0.011	0.005
Cyanide (total)	0.002	0.001
Zinc	0.009	0.004
Ammonia (as N)	1.160	0.510
Combined metals	0.003	

(h) Gold Precipitation and Filtration PSNS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of gold precipitated		
Copper	5.632	2.684
Cyanide (total)	0.880	0.352
Zinc	4.488	1.848
Ammonia (as N)	586.500	257.800
Combined metals	1.320	

(i) Platinum Precipitation and Filtration PSNS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of platinum precipitated		
Copper	6.656	3.172
Cyanide (total)	1.040	0.416
Zinc	5.304	2.184
Ammonia (as N)	693.200	304.700
Combined metals	1.560	

(j) Palladium Precipitation and Filtration PSNS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of palladium precipitated		
Copper	7.680	3.660
Cyanide (total)	1.200	0.480
Zinc	6.120	2.520
Ammonia (as N)	799.800	351.600
Combined metals	1.800	

(k) Other Platinum Group Metals Precipitation and Filtration PSNS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of other platinum group metals precipitated		
Copper	6.656	3.172
Cyanide (total)	1.040	0.416
Zinc	5.304	2.184
Ammonia (as N)	693.200	304.700
Combined metals	1.560	

(l) Spent Solution from PGC Salt Production PSNS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of gold contained in PGC product		
Copper	1.152	0.549
Cyanide (total)	0.180	0.072
Zinc	0.918	0.378
Ammonia (as N)	120.000	52.740
Combined metals	0.270	

(m) Equipment and Floor Wash PSNS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of precious metals, including silver, produced in refinery		
Copper	0.000	0.000
Cyanide (total)	0.000	0.000
Zinc	0.000	0.000
Ammonia (as N)	0.000	0.000
Combined metals	0.000	

(n) Preliminary treatment PSNS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of total precious metals produced through this operation		
Copper	64.000	30.500
Cyanide (total)	10.000	4.000
Zinc	51.000	21.000
Combined metals	15.000	--
Ammonia (as N)	6665.000	2930.000

EPA is not promulgating best conventional pollutant control technology (BCT) at this time.

SECTION III

SUBCATEGORY PROFILE

This section of the secondary precious metals supplement describes the raw materials and processes used in refining secondary precious metals and presents a profile of the secondary precious metals plants identified in this study. For a discussion of the purpose, authority, and methodology for this study and a general description of the nonferrous metals category, refer to Section III of Vol. I.

DESCRIPTION OF SECONDARY PRECIOUS METALS PRODUCTION

The secondary precious metals industry consists of plants which recover gold and platinum group metals from recycled materials. Platinum group metals, also known as PGM, consist of platinum, palladium, iridium, rhodium, osmium, and ruthenium. The production of secondary precious metals can be divided into two stages: raw material preparation steps and refining steps. Raw material preparation steps include grinding, crushing, incineration, smelting, granulation, cyanide stripping, and precipitation of precious metals from spent plating solutions. Refining steps include dissolution in either strong acid or base, precipitation, filtration, recycle, solvent extraction, electrolytic refining, salt manufacturing, casting, and granulation. The secondary precious metals production process is presented schematically in Figure III-1 (page 2343).

RAW MATERIALS

The principal raw materials used by plants recovering precious metals are jewelry scrap, dental scrap, optical scrap, electrical scrap, impure bullion, spent industrial and automotive catalysts, sweeps, and contaminated or spent electroplating solutions. Sweeps are usually low-grade precious metal-bearing residue generated from various raw materials, including floor sweepings (hence the name); waste treatment sludges and incinerated filter cakes. The various raw material preparation and refining steps a plant uses are dictated by the type and composition of raw materials being processed.

RAW MATERIAL PREPARATION STEPS

Based on the source of raw materials, the raw material preparation steps can be divided into five basic processes for the recovery of precious metals: incineration and smelting (pyrometallurgical steps), raw material granulation, stripping with cyanide solutions, recovering precious metals from spent plating solutions, and other preliminary treatment steps.

Incineration and Smelting

Dental scrap, optical scrap, electrical scrap, and catalysts may be ground and incinerated in a furnace in order to remove the carbonaceous material and volatile fraction. The temperature and rate of burning must be carefully controlled if high efficiency is to be maintained. Air emissions include vapors from the volatilization and decomposition of carbonaceous scrap contaminants, as well as combustion gases and dust. The emissions are usually controlled by afterburners in series with a baghouse or scrubber. Wet air pollution control techniques result in wastewater discharges. Precious metal-bearing residues may then be fed directly to the refinery for recovery of pure metals.

Smelting is generally used to produce a copper-based bullion which can either be sold or further processed to produce a pure metal. The raw material for smelting may be the precious metal-bearing residue produced in the incinerator, or it may be ground-up raw material. Like the incineration furnace, the smelting furnace may also have emissions which are controlled by a baghouse or scrubber. The furnace or incinerator scrubber results in a wastewater discharge.

Raw Material Granulation

Raw material may be granulated with water in order to make it easier to dissolve in acid in the refinery. Either solid scrap or incinerated residue may be melted in a furnace and granulated with water in a similar manner to shot casting. This operation produces wastewater discharge, consisting of the spent granulation water.

Stripping With Cyanide Solutions

Gold-containing electrical components, strip, or ceramics may be stripped with sodium or potassium cyanide solutions. The raw material may be ground-up prior to stripping in order to increase the exposed surface area. Cyanide attacks the gold which is exposed on the surface of the metal, but does not recover gold which is buried beneath a non-precious metal. Stripping with cyanide has limited application because of the relatively few types of scrap amenable to the process.

After the gold is stripped away from the base metal, it may be precipitated from solution with either sodium hydrosulfite or zinc. An oxidizing agent may be added to destroy the free cyanide. The solids, containing precious metals, are separated from the spent cyanide stripping solution by filtration. Filtration results in a wastewater stream which may be discharged. The product of cyanide stripping is a sludge containing high precious metal values which may be further processed.

Recovery From Spent Plating Solutions

Precious metals can be recovered from contaminated or spent electroplating solutions, which are cyanide-based, either by precipitation with sodium hydrosulfite or zinc, or by electrolysis. Electroplaters use cyanide solutions for plating precious metals onto base metals. The depleted or contaminated solutions still contain enough precious metal values to make recovery economical. Either gold, palladium, or rhodium can be recovered in this manner. The precipitation process for plating solutions is the same as cyanide stripping. Zinc or sodium hydrosulfite is added and the precious metals are recovered by filtration. For electrolytic recovery, the spent plating solution acts as the electrolyte, and the precious metal is recovered on the cathode. Wastewater may be generated by the discharge of barren solution after either precipitation or electrolytic recovery occurs. The resultant sludge from this process may be routed to the refinery for further processing.

Other Preliminary Treatment Steps

Preliminary treatment steps other than those mentioned above may be used to treat raw material in this subcategory. These processing steps, which have been claimed confidential are used to treat non-combustible, non-metallic-based basis materials. These preliminary treatment steps may produce a wastewater discharge.

REFINING STEPS

Refining steps are taken to recover high-purity precious metals (high-purity generally refers to 99.9 or 99.99 percent pure) from lower purity raw materials, which may or may not have undergone raw material preparation steps. The standard hydrometallurgical process includes dissolution in acid or base, combined with precipitation and filtration. Other hydrometallurgical refining steps include solvent extraction and electrolytic refining. After pure precious metals are produced, they may be further processed into a potassium cyanide-based salt, cast as bars, or granulated.

Hydrometallurgical Processing

Jewelry, dental, optical, electrical, and catalyst scrap, along with sludges generated from spent solutions, containing gold, platinum, palladium, and other platinum group metals (PGM), may be refined using hydrometallurgical processing. The first step usually consists of dissolving the raw material in aqua regia. Aqua regia (one part concentrated nitric acid:three to four parts concentrated hydrochloric acid) is the only known reagent that dissolves gold. Nitric acid alone cannot oxidize gold unless the chloride ion is present to complex the product. The net equation for dissolving gold in aqua regia can be written as below although a variety of nitrogen products may be obtained.

$$Au(s) + 4NO_3^- + 4Cl^- + 8H_3O^+ \text{----}> AuCl_4 + 4NO_2(g) + 12H_2O$$

After dissolving the raw material, the silver chloride solids are filtered away, the nitrates are removed, and the gold is precipitated with sulfur dioxide, ferrous sulfate, or chlorine gas. The filtrate may be sent on for further recovery of platinum group metals, if these are present. The silver chloride solids recovered from the gold dissolution process usually require further purification. Silver recovery and purification is addressed in the secondary silver development document.

Platinum group metals are recovered from raw materials which contain gold and platinum group metals. Platinum is recovered by dissolution in a chlorinated acid solution, yielding soluble platinum chloride. Platinum is precipitated as an insoluble amine called yellow salt which is purified using both alkaline and acid solutions and reduced to platinum metal sponge either thermally or with a strong chemical reducing agent.

Palladium is recovered by dissolution in acid as a soluble chloride salt. Palladium is precipitated from solution as an insoluble amine called red salt. Palladium is purified by redissolving the red salt in an alkaline solution followed by reprecipitation. The red salt is reduced to palladium metal sponge with a strong chemical reducing agent.

Each of the purification processes may be repeated via recycle to increase the purity of the refined metal. After each metal is recovered as either a final product or intermediate, it may be washed with water or an acid or base in order to remove residual acid or base from it and to further purify it. The wash water or solution is generally discharged with the precipitation and filtration water, and is considered as part of the same waste stream.

The various hydrometallurgical processing steps a plant uses to recover precious metals may occur in any order. For example, one plant may recover gold prior to palladium prior to platinum, and another plant may recover platinum first, then gold, and finally palladium. The order of processing does not impact the wastewater generation at a refinery.

Based on the composition of the raw material, and the order of processing, the recovery of each precious metal may result in a wastewater discharge. There is variability in the types of raw materials processed within this subcategory; however, the basic processing steps and wastewaters generated are similar from one plant to another.

Acid fumes generated in the refinery may be controlled with a wet scrubber, resulting in a wastewater stream. In many plants, this scrubber controls the fumes from all the reaction vessels, whether they are acid, alkaline, or cyanide based. The scrubbing medium is usually an alkaline solution which neutralizes the acid fumes. Other plants may use separate scrubbers for acid and alkaline fumes.

Solvent Extraction

Solvent extraction may be used to refine impure bullion to high purity gold. Solvent extraction consists of extracting the gold from an acid solution into the organic phase and subsequently recovering it. The aqueous solution which originally contained the dissolved impure bullion may be discharged as a waste stream. After recovery, the gold may be washed with water and the wash water may also be discharged. The aqueous raffinate and wash water may be considered as one waste stream.

Electrolytic Refining

Electrolytic refining is also used as a means of recovering high purity gold from precious metal-containing bullion, jewelry and dental scrap. First, the raw material is melted and cast as an anode. An acidic electrolyte is used, and gold is recovered on the cathode. In the electrolytic method, a current is passed between an anode and a cathode which are suspended in the electrolyte. A portion of the electrolyte is periodically discharged to maintain the purity of the solution.

Further Processing

Once the gold or platinum group metals have been refined to the pure state, they may be further processed. Gold may be reacted with potassium cyanide solution to produce a potassium gold cyanide salt (generally written $KAu(CN)_2$ or PGC) which is useful in the electroplating industry. There may be a waste stream associated with this process, consisting of excess cyanide solution.

Pure precious metals may either be cast as bars or granulated using a method similar to shot casting. In either case, the metal is melted in a furnace. Molten metal may be poured into molds which may be quenched with water, or it may be poured directly into a container of water, in which case it will be granulated. In either case, a waste stream is generated which may be discharged.

PROCESS WASTEWATER SOURCES

Although a variety of processes are involved in secondary precious metals production, the process wastewater sources can be subdivided into building blocks as follows:

1. Furnace wet air pollution control,
2. Raw material granulation,
3. Spent plating solutions,
4. Spent cyanide stripping solutions,
5. Refinery wet air pollution control,

6. Gold solvent extraction raffinate and wash water,
7. Gold spent electrolyte,
8. Gold precipitation and filtration,
9. Platinum precipitation and filtration,
10. Palladium precipitation and filtration,
11. Other platinum group metals precipitation and filtration,
12. Spent solution from PGC salt production,
13. Equipment and floor wash, and
14. Preliminary treatment.

The sources of these wastewater streams are identified by their respective numbers in Figure III-1 (page 2343).

OTHER WASTEWATER SOURCES

There are other waste streams associated with the production of secondary precious metals. These waste streams may include casting contact cooling water, final product granulation water, acid storage area wet air pollution control, and pump seal water.

These waste streams are not considered as part of this rulemaking. EPA believes that the flows and pollutant loadings associated with these wastewater streams are insignificant relative to the wastewater streams selected and are best handled by the appropriate permit authority on a case-by-case basis under the authority of Section 403(a) of the Clean Water Act.

Casting contact cooling water is not considered as part of this rulemaking because, although several plants do discharge this stream, sampling data indicate that this wastewater contains little or no pollutants and that the pollutant loadings are insignificant compared with the other waste streams selected. Sampling data for casting contact cooling water are presented in Table V-26 (page 2497).

AGE, PRODUCTION, AND PROCESS PROFILE

Forty-nine secondary precious metals plants were identified in this study. Figure III-2 (page 2344) shows that the plants are concentrated in the Northeast and California, with plants also located in Washington, Arizona, Minnesota, Illinois, Ohio, Virginia, and Florida.

Table III-1 (page 2340) summarizes the relative ages of the secondary precious metals plants by discharge status. Four plants discharge directly, 30 are indirect dischargers, 10 are zero dischargers, and five plants do not generate process wastewater. Most of the Plants began operating within the last 15 years.

Table III-2 (page 2341) shows the production ranges for the 49 secondary precious metals plants. One-third of the plants that reported production data produce less than 10,000 troy ounces of total precious metals per year. All four of the direct dischargers produce in excess of 50,000 troy ounces per year, as do 10 of the indirect dischargers.

Table III-3 (page 2342) provides a summary of the plants having the various secondary precious metals processes. The number of plants generating wastewater from the processes is also shown.

Table III-1

INITIAL OPERATING YEAR (RANGE) SUMMARY OF PLANTS IN THE SECONDARY PRECIOUS METALS SUBCATEGORY BY DISCHARGE TYPE

Type of Plant Discharge	1983-1973 1-10	1972-1968 11-15	1967-1958 16-25	1957-1948 26-35	1947-1938 36-45	1937-1928 46-55	1927-1918 56-55	1917-1903 66-80	<1903 81+	Not Reported	Total
Direct	1	1						1	1		4
Indirect	8	8	4	3	1	1	1	2	1	1	30
Zero	4	2	1							3	10
Dry	2	—	1	—	1	—	1	—	—	—	5
Total	15	11	6	3	2	1	2	3	2	4	49

Table III-2

PRODUCTION RANGES FOR THE SECONDARY PRECIOUS METALS SUBCATEGORY DURING 1982 (TROY OUNCES OF TOTAL PRECIOUS METALS/YEAR)

Type of Plant	0-1,000	1,001-10,000	10,001-50,000	50,001-100,000	100,001-500,000	500,000+	Not Reported in dcp
Direct*							
Indirect	1	9	9	4	6	1	
Zero		3	1		4		2
Dry	1	1	1	–	—	2	1
Total	2	13	11	4	10	3	3

---

*Data for these plants are claimed to be confidential.

Table III-3

SUMMARY OF SECONDARY PRECIOUS METALS SUBCATEGORY PROCESSES AND ASSOCIATED WASTE STREAMS

Process	Number of Plants With Process	Number of Plants Reporting Generation of Wastewater*
Raw Materials Preparation Steps	28	
- Incineration and Smelting (Furnace Air Pollution Control)	18	7
- Raw Material Granulation	4	4
- Stripping With Cyanide Solutions	6	6
- Recovery From Spent Plating Solutions	12	12
Refining Steps (Hydrometallurgical Processing)	37	
- Gold Precipitation and Filtration	28	28
- Platinum Precipitation and Filtration	18	18
- Palladium Precipitation and Filtration	20	20
- Other Platinum Group Metals Precipitation and Filtration	3	3
- Solvent Extraction	1	1
- Electrolytic Refining	3	3
PGC Salt Production	4	4
Equipment and Floor Wash	3	3

---

*Through reuse or evaporation practices, a plant may "generate" wastewater from a particular process but not discharge it.

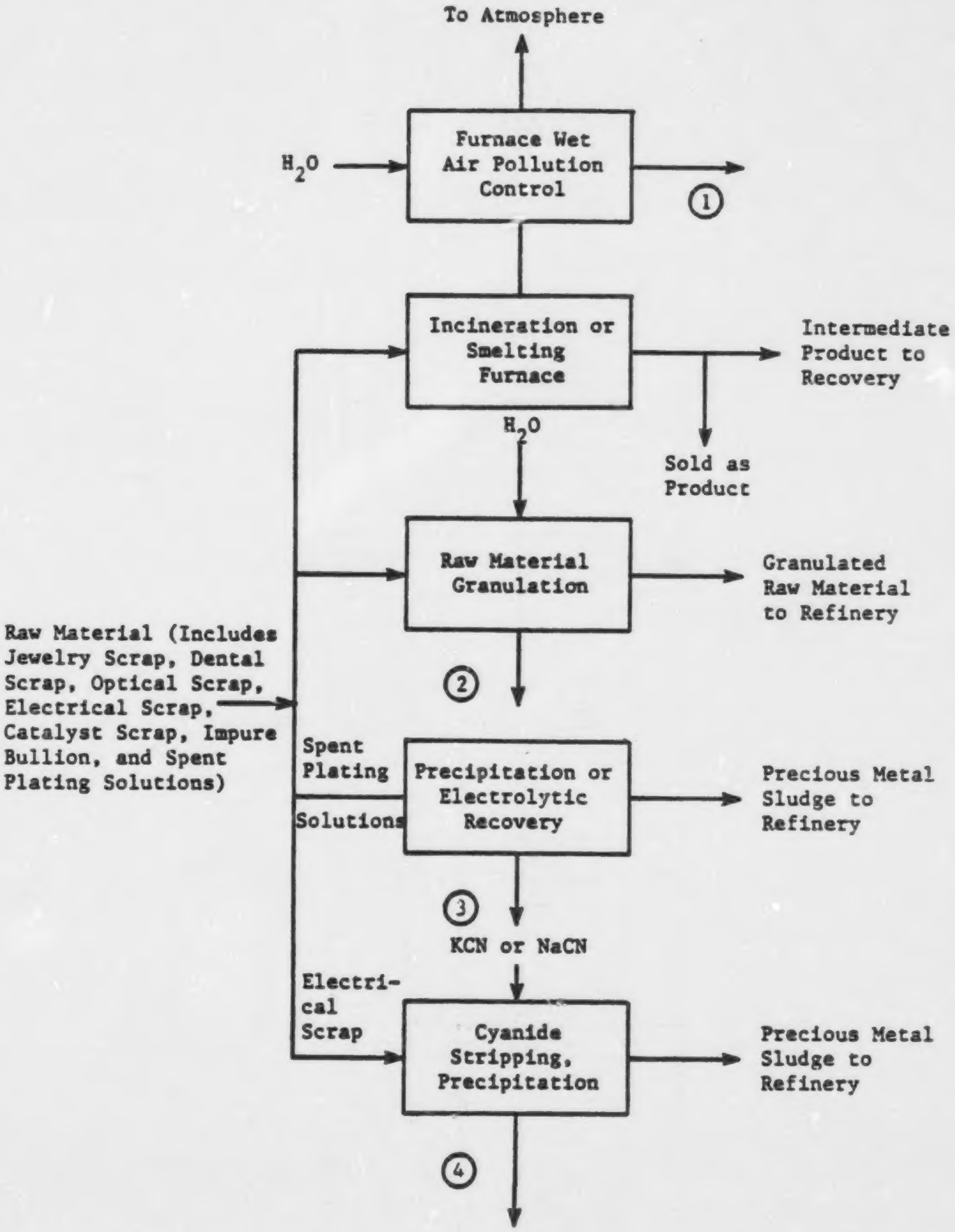
To Atmosphere
H_2O
Furnace Wet Air Pollution Control
①
Incineration or Smelting Furnace
Intermediate Product to Recovery
H_2O
Sold as Product
Raw Material Granulation
Granulated Raw Material to Refinery
Raw Material (Includes Jewelry Scrap, Dental Scrap, Optical Scrap, Electrical Scrap, Catalyst Scrap, Impure Bullion, and Spent Plating Solutions)
②
Spent Plating Solutions
Precipitation or Electrolytic Recovery
Precious Metal Sludge to Refinery
③
KCN or NaCN
Electrical Scrap
Cyanide Stripping, Precipitation
Precious Metal Sludge to Refinery
④

Figure III-1

RAW MATERIAL PREPARATION
SECONDARY PRECIOUS METALS PRODUCTION PROCESSES

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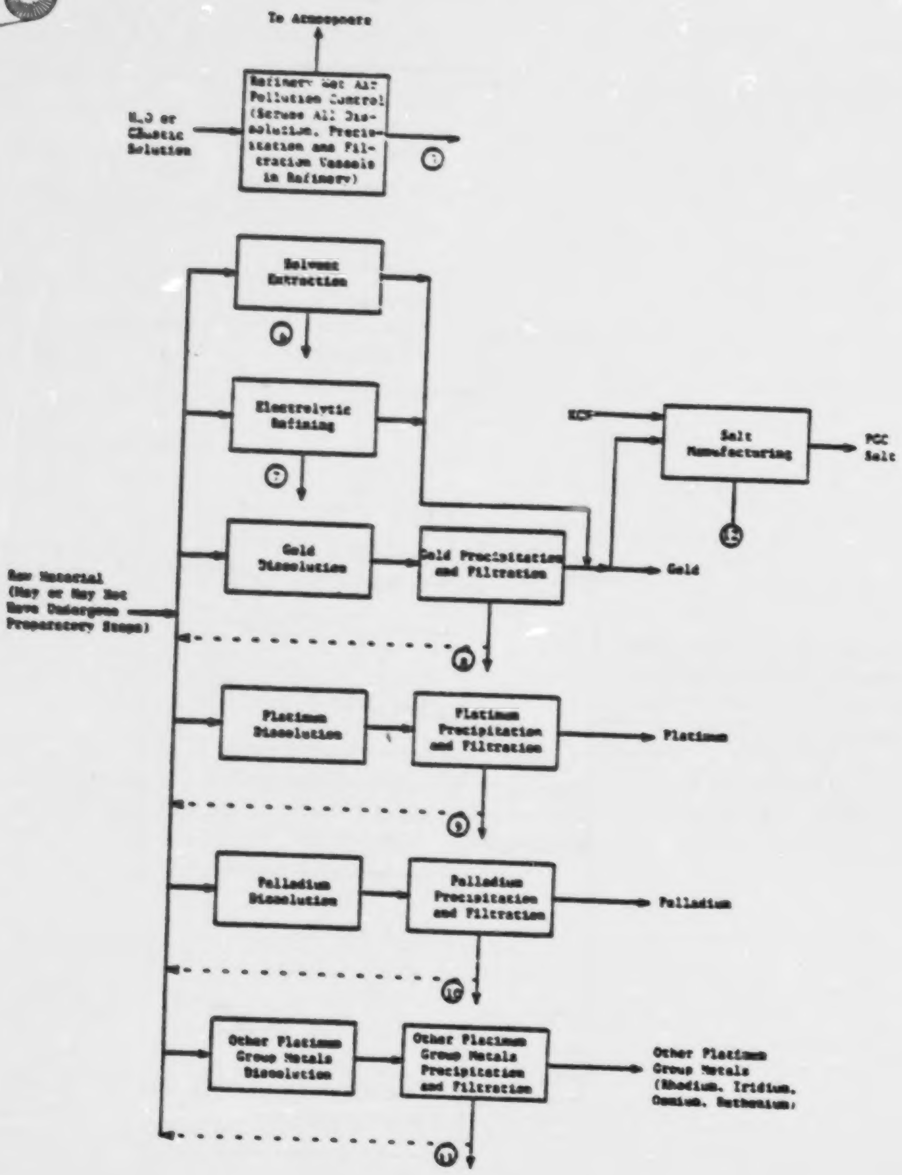
To Atmosphere
Refinery Wet Air Pollution Control (Scrubs All Dissolution, Precipitation and Filtration Vessels in Refinery)
H_2O or Caustic Solution
Solvent Extraction
6
Electrolytic Refining
7
KCN
Salt Manufacturing
PGC Salt
12
Raw Material (May or May Not Have Undergone Preparatory Steps)
Gold Dissolution
Gold Precipitation and Filtration
Gold
8
Platinum Dissolution
Platinum Precipitation and Filtration
Platinum
9
Palladium Dissolution
Palladium Precipitation and Filtration
Palladium
10
Other Platinum Group Metals Dissolution
Other Platinum Group Metals Precipitation and Filtration
Other Platinum Group Metals (Rhodium, Iridium, Osmium, Ruthenium)
11

Note: Dashed line indicates possible recycle or reuse of filtrate

Figure III-1 (Continued)

REFINING STEPS

SECONDARY PRECIOUS METALS PRODUCTION PROCESSES

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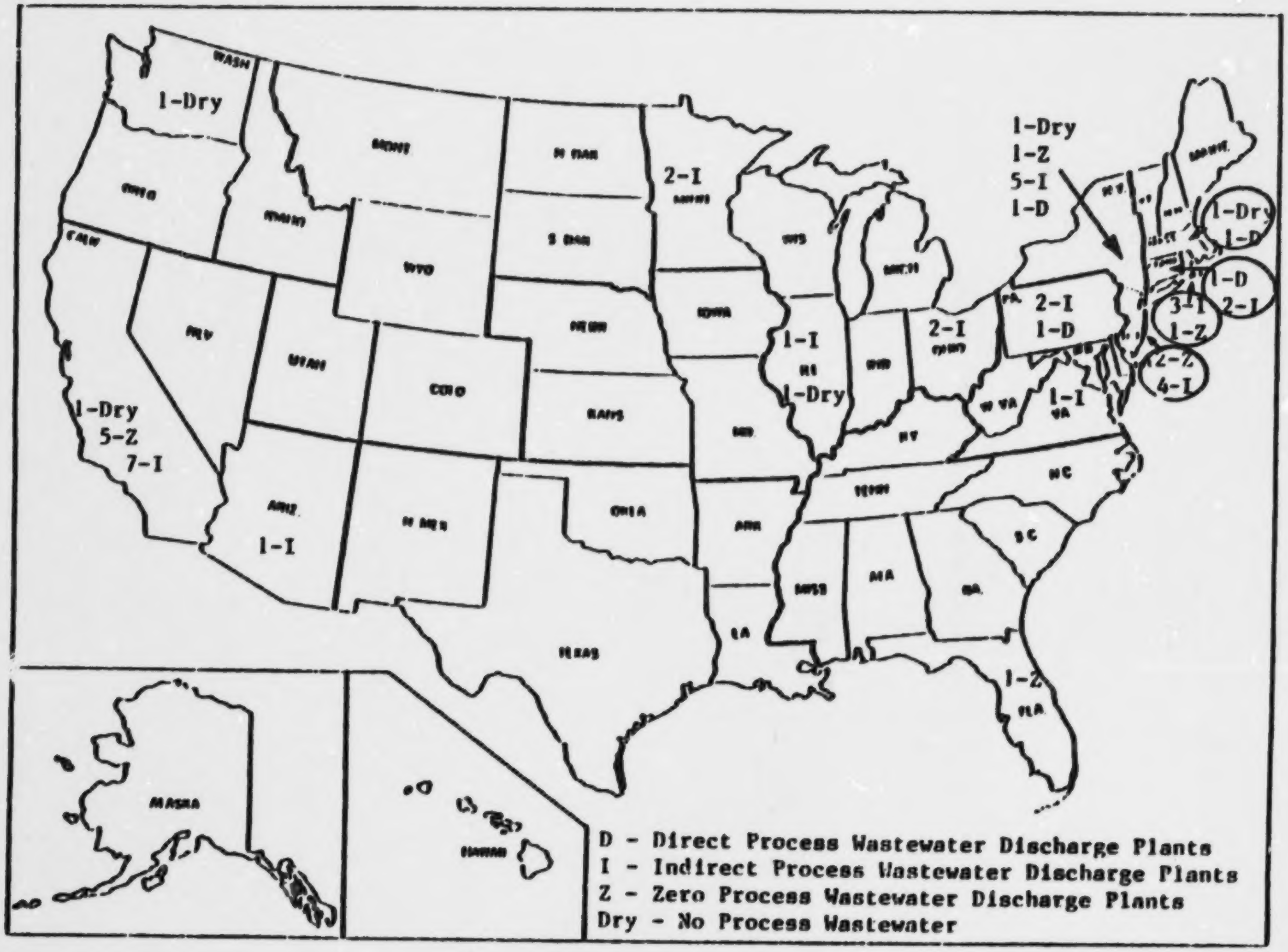
WASH
1-Dry
CALIF
1-Dry
5-Z
7-I
ARIZ
1-I
MINN
2-I
ILL
1-I
1-Dry
OHIO
2-I
PA
2-I
1-D
VA
1-I
FLA
1-Z
1-Dry
1-Z
5-I
1-D
1-Dry
1-D
1-D
2-I
3-I
1-Z
2-Z
4-I
NC
SC
LA
ALASKA
HAWAII
D - Direct Process Wastewater Discharge Plants
I - Indirect Process Wastewater Discharge Plants
Z - Zero Process Wastewater Discharge Plants
Dry - No Process Wastewater

Figure III-2
GEOGRAPHIC LOCATIONS OF THE SECONDARY PRECIOUS METALS INDUSTRY

SECTION IV

SUBCATEGORIZATION

This section summarizes the factors considered during the designation of the related subdivisions or building blocks of the secondary precious metals subcategory.

FACTORS CONSIDERED IN SUBDIVIDING THE SECONDARY PRECIOUS METALS SUBCATEGORY

The factors listed previously for general subcategorization were each evaluated when considering subdivision of the secondary precious metals subcategory. In the discussion that follows the factors will be described as they pertain to this particular subcategory.

The rationale for considering further subdivision of the secondary precious metals subcategory is based primarily on the production processes used. Within the subcategory a number of different operations are performed which may or may not have a water use or discharge and which may require the establishment of separate effluent limitations and standards. While secondary precious metals is still considered a single Subcategory. a more thorough examination of the production processes, water use and discharge practices and pollutant generation rates has illustrated the need for limitations and standards based on a set of specific wastewater streams. Limitations and standards will be based on specific flow allowances for the following building blocks:

1. Furnace wet air pollution control.
2. Raw material granulation,
3. Spent plating solutions.
4. Spent cyanide stripping solutions,
5. Refinery wet air pollution control,
6. Gold solvent extraction raffinate and wash water,
7. Gold spent electrolyte,
8. Gold precipitation and filtration.
9. Platinum precipitation and filtration,
10. Palladium precipitation and filtration,
11. Other platinum group metals precipitation and filtration,
12. Spent solution from PGC salt production,
13. Equipment and floor wash, and
14. Preliminary treatment.

These building blocks follow directly from differences within the various production stages of secondary precious metals: raw material preparation steps and refining steps. Depending on the type and composition of raw material, a plant may operate one or more raw material preparation or refining steps to recover gold platinum, palladium, or other platinum group metals from scrap. Each of these operations may create a need for a subdivision.

Smelting or incinerating a raw material creates the need for the first subdivision--furnace wet air pollution control. Smelting or incineration furnaces produce dust and particulate emissions which need to be controlled prior to venting to the atmosphere. Other raw material preparation steps which create the need for subdivisions include raw material granulation, recovering gold or other precious metals from spent plating solutions, cyanide stripping of gold from gold-plated scrap, and other confidential preliminary treatment steps. Granulating a raw material involves melting the raw material in a furnace and pouring it into a container of water. This granulates the raw material, and the granulation water may be discharged, thus creating the need for a subdivision. Spent plating solutions may be treated with a precipitating agent such as zinc or sodium thiosulfate in order to precipitate the precious metals. Discharging the depleted solution creates a need for a separate subdivision. Stripping gold away from scrap with a cyanide solution and then precipitating the gold from solution creates a need for the fourth pre-refining subdivision. Other preliminary treatment steps, which are considered confidential are used to treat non-combustible, non-metallic-based basis materials, and create a need for the last subdivision.

Various refining operations create the need for the other nine subdivisions. Recovering gold by a solvent extraction process or an electrolytic refining process creates the need for two subdivisions: gold solvent extraction raffinate and wash water, and gold spent electrolyte. The wet chemistry technique of dissolution and selective precipitation creates the need for four subdivisions: gold precipitation and filtration, platinum precipitation and filtration palladium precipitation and filtration, and other platinum group metals precipitation and filtration. Depending on the composition of the raw material being processed, and the manner in which each metal is recovered, any one or all of the precious metals may result in the discharge of a wastewater stream.

Acid fumes generated during dissolution and precipitation processes are generally controlled with a wet scrubber, creating the need for the seventh refining subdivision: refinery wet air pollution control. Washing the equipment and the floor of the refinery in order to recover any precious metals from spills and leaks creates a need for the equipment and floor wash subdivision. Finally, manufacturing gold into a PGC salt product by reacting it with potassium cyanide solution creates a need for a subdivision: spent solution from PGC salt production.

OTHER FACTORS

The other factors considered in this evaluation were shown to be inappropriate as a bases for further segmentation of the subcategory. Air pollution control methods, treatment costs, nonwater quality aspects, and total energy requirements are functions of the selected subcategorization factors -- raw materials and production processes. As such, they support the method of subcategorization which has been developed. As discussed in Section IV of the General Development Document, certain other factors such as plant age, plant size, and the number of employ-ees were also evaluated and determined to be inappropriate for use as bases for subdivision of nonferrous metals plants.

PRODUCTION NORMALIZING PARAMETERS

The effluent limitations and standards developed in this document establish mass limitations for the discharge of specific pollutant parameters. To allow these limitations to be applied to plants with various production capacities, the mass of pollutant discharged must be related to a unit of production. This factor is known as the production normalizing parameter (PNP). In general, the actual precious metals production from the respective manufacturing process is used as the PNP. This is based on the principle that the amount of water generated is proportional to the amount of product made. Therefore, the PNPs for the 14 secondary precious metals subdivisions are as follows:

	Building Block	PNP
1.	Furnace wet air pollution control	Troy ounces of precious metals, including silver, incinerated or smelted
2.	Raw material granulation	Troy ounces of precious metals in the granulated raw material
3.	Spent plating solutions	Liters of spent plating solutions used as a raw material
4.	Spent cyanide stripping solutions	Troy ounces of gold produced by cyanide stripping
5.	Refinery wet air pollution control	Troy ounces of precious metals, including silver, produced in refinery
6.	Gold solvent extraction raffinate and wash water	Troy ounces of gold produced of solvent extraction
7.	Gold spent electrolyte	Troy ounces of gold produced by electrolysis
8.	Gold precipitation and filtration	Troy ounces of gold precipitated
9.	Platinum precipitation and filtration	Troy ounces of platinum precipitated
10.	Palladium precipitation and filtration	Troy ounces of palladium precipitated
11.	Other platinum group	Troy ounces of other platinum

	metals precipitation and filtration	group metals precipitated
12.	Spent solution from PGC salt production	Troy ounces of gold contained in PGC product
13.	Equipment and floor wash	Troy ounces of precious metals, including silver, produced in refinery
14.	Preliminary treatment	Troy ounces of total precious metals produced through this operation

Other PNPs were considered. The use of production capacity instead of actual production was eliminated from consideration because the mass of pollutant produced is more a function of true production than of installed capacity. The total precious metals produced in the refinery was eliminated from consideration because most of the operations generating wastewater in a refinery do so as a function of one metal being produced, rather than as a function of the total amount of metal produced in a refinery.

The PNP selected for spent plating solutions is liters of spent plating solution used as a raw material. The volumetric PNP was selected rather than the mass of metal processed because a plant cannot control the concentration of precious metals in the raw material -- the imported spent plating solutions. One plant's raw material may be many times as concentrated as anothers' in precious metals, and therefore flow cannot be related to production for this unit operation. Wastewater discharge flow is directly related to volume of spent plating solution used as raw material, and not the quantity of precious metals in the solution.

SECTION V

WATER USE AND WASTEWATER CHARACTERISTICS

This section describes the characteristics of the wastewaters associated with the secondary precious metals subcategory. Water use and discharge rates are explained and then summarized in tables at the end of this section. Data used to characterize the wastewaters are presented. Finally, the specific source, water use and discharge flows, and wastewater characteristics for each separate wastewater source are discussed.

The two principal data sources were used in the development of effluent limitations and standards for this subcategory are data collection portfolios (dcp) and field sampling results. Data collection portfolios contain information regarding wastewater flows and production levels.

In order to quantify the pollutant discharge from secondary precious metals plants, a field sampling program was conducted. A complete list of the pollutants considered and a summary of the techniques used in sampling and laboratory analyses are included in Section V of the General Development Document. Samples were analyzed for 124 of the 126 priority pollutants and other pollutants deemed appropriate. Because the analytical standard for TCDD was Judged to be too hazardous to be made generally available, samples were never analyzed for this pollutant. Samples were also never analyzed for asbestos. There is no reason to expect that TCDD or asbestos would be present in nonferrous metals manufacturing wastewater. A total of five plants were selected for sampling in the secondary precious metals subcategory. In general, the samples were analyzed for cyanide and three classes of pollutants: priority organic pollutants, priority metal pollutants, and criteria pollutants (which includes both conventional and nonconventional pollutants). Cyanide was analyzed for because it is present in raw materials for this subcategory.

Additional wastewater characteristics and flow and production data were received through industry comments and an engineering site visit to one facility between proposal and promulgation. This aided EPA in promulgating revised discharge allowances for raw material granulation and spent cyanide stripping solutions waste streams.

Also since proposal, EPA gathered additional wastewater sampling data for four of the subdivisions in this subcategory through a self-sampling program which was specifically requested by the Agency. The data from this program include data from analyses for the primary metals antimony, arsenic, beryllium, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, thallium, and zinc. The data also include analyses for cyanide and the nonconventional pollutants ammonia, gold, palladium, and platinum. These data support the assumptions which EPA had made concerning the presence and concentrations of pollutants in those subdivisions where we did not have analytical data for specific pollutants. For this reason, the selection of pollutant parameters for limitation in this subcategory (Section VI) has not been revised based on this new data.

As described in Section IV of this supplement, the secondary precious metals subcategory has been further subdivided into 14 building blocks, so that the promulgated regulation contains mass discharge limitations and standards for 14 process wastewater discharging subdivisions. Differences in the wastewater characteristics associated with these subdivisions are to be expected. For this reason, wastewater streams corresponding to each subdivision are addressed separately in the discussions that follow.

The principal wastewater sources in the secondary precious metals subcategory are:

1. Furnace wet air pollution control,
2. Raw material granulation,
3. Spent plating solutions,
4. Spent cyanide stripping solutions,
5. Refinery wet air pollution control,
6. Gold solvent extraction raffinate and wash water,
7. Gold spent electrolyte,
8. Gold precipitation and filtration,
9. Platinum precipitation and filtration,
10. Palladium precipitation and filtration,
11. Other platinum group metals precipitation and filtration,
12. Spent solution from PGC salt production,
13. Equipment and floor wash, and
14. Preliminary treatment.

WASTEWATER FLOW RATES

Data supplied by dcp responses were evaluated, and two flow-to-production ratios were calculated for each stream. The two ratios, water use and wastewater discharge flow, are differentiated by the flow value used in calculation. Water use is defined as the volume of water or other fluid required for a given process per mass of precious metals product and is therefore based on the sum of recycle and make-up flows to a given process. Wastewater flow discharged after preliminary treatment or recycle (if these are present) is used in calculating the production normalized flow -- the volume of wastewater discharged from a given process to further treatment, disposal, or discharge per mass of precious metals produced. Differences between the water use and wastewater flows associated with a given stream result from recycle, evaporation, and carry-over on the product. The production values used in calculation correspond to the production normalizing parameter, PNP, assigned to each stream, as outlined in Section IV. As an example, gold precipitation and filtration wastewater flow is related to gold metal production. As such, the discharge rate is expressed in liters of filtration wastewater discharged per troy ounce of gold produced by precipitation.

The production normalized flows were compiled and statistically analyzed by stream type. These production normalized water use and discharge flows are presented by subdivision in Tables V-1 through V-13 (pages 2360-2372). Where appropriate, an attempt was made to identify factors that could account for variations in water use. This information is summarized in this section. A similar analysis of factors affecting the wastewater flows is presented in Sections IX, X, XI, and XII where representative BPT, BAT, NSPS, and pretreatment flows are selected for use in calculating the effluent limitations and standards.

WASTEWATER CHARACTERIZATION DATA

Data used to characterize the various wastewaters associated with secondary precious metals production come from two sources -- data collection portfolios and analytical data from field sampling trips.

DATA COLLECTION PORTFOLIOS

In the data collection portfolios, the secondary precious metals plants which discharge wastewater were asked to specify the presence of toxic pollutants in their effluent. Of the 49 secondary precious metals plants, 12 did not respond to this portion of the questionnaire. No plant responding to this portion of the questionnaire reported that any toxic organic pollutants were known to be or believed to be present in their wastewater.

The responses for the toxic metals and cyanide are summarized below:

Pollutant	Known Present	Believed Present (Based on Raw Materials and Process Chemicals Used)
Antimony	0	3
Arsenic	1	5
Beryllium	2	3
Cadmium	7	5
Chromium	9	6
Copper	20	17
Cyanide	10	10
Lead	11	8
Mercury	3	2
Nickel	16	19
Selenium	0	3
Silver	14	18

Thallium	0	2
Zinc	20	15

FIELD SAMPLING DATA

In order to quantity the concentrations of pollutants present in wastewater from secondary precious metals plants, wastewater samples were collected at five plants. Diagrams indicating the sampling sites and contributing production processes are shown in Figures V-1 through V-5 (pages 2360-2364).

The raw wastewater sampling data for the secondary precious metals subcategory are Presented in Tables V-14 through V-21 (pages 2373-2436). Treated and combined wastewater sampling data are shown in Tables V-22 through V-25 (pages 2440-2484). The stream codes presented in the tables may be used to identify the location of each of the samples on the process flow diagrams in Figures V-1 through V-5. Where no data are listed for a specific day of sampling, the wastewater samples for the stream were not collected.

Several points regarding these tables should be noted. First, the data tables include some samples measured at concentrations considered not quantifiable. The base-neutral extractable, acid traction extractable, and volatile organics are generally considered not quantifiable at concentrations equal to or less than 0.010 mg/l. Below this concentration, organic analytical results are not quantitatively accurate; however, the analyses are useful to indicate the presence of a particular pollutant. The pesticide fraction is considered not quantifiable at concentrations equal to or less than 0.005 mg/l.

Second, the detection limits shown on the data tables for priority metals and conventional and nonconventional pollutants are not the same in all cases as the published detection limits for these pollutants by the same analytical methods. The detection limits used were reported with the analytical data and hence are the appropriate limits to apply to the data. Detection limit variation can occur as a result of a number of laboratory-specific, equipment-specific, and daily operator-specific factors. These factors can include day-to-day differences in machine calibration, variation in stock solutions, and variation in operators.

Third, the statistical analysis of data includes some samples measured at concentrations considered not quantifiable. For data considered as detected but below quantifiable concentrations, a value of zero is used for averaging. Priority organic, nonconventional, and conventional pollutant data reported with a "less than" sign are considered as detected, but not further quantifiable. A value of zero is also used for averaging. If a pollutant is reported as not detected, it is assigned a value of zero in calculating the average. Finally, priority metal values reported as less than a certain value were considered as not quantifiable, and consequently were assigned a value of zero in the calculation of the average.

Finally, appropriate source water concentrations are presented with the summaries of the sampling data. The method by which each sample was collected is indicated by number, as follows:

1. One-time grab
2. Manual composite during intermittent process operation
3. 38-hour manual composite
4. 8-hour automatic composite
5. 24-hour manual composite
6. 24-hour automatic composite

WASTEWATER CHARACTERISTICS AND FLOWS BY SUBDIVISION

Since secondary precious metals production involves 14 principal sources of wastewater and each has potentially different characteristics and flows, the wastewater characteristics and discharge rates corresponding to each subdivision will be described separately. A brief description of why the associated production processes generate a wastewater and explanations for variations of water use within each subdivision will also be discussed.

FURNACE WET AIR POLLUTION CONTROL

Of the secondary precious metals plants with furnaces, smelters, or incinerators, seven plants use wet scrubbers to control emissions. Five of these discharge wastewater as shown in Table V-1 page 2360). This table shows the water discharge rates in liters per troy ounce of precious metals, including silver, processed through the furnace. Of the seven plants using wet scrubbers, two plants practice 100 percent recycle, two plants practice greater than 90 percent recycle, and three plants do not recycle this water.

The Agency sampled the wastewater from two of the five discharging plants, one of which does not practice recycle. The other practices greater than 90 percent recycle. The Agency also sampled the wastewater at another secondary precious metals plant which did not practice recycle. Furnace wet air pollution control raw wastewater contains priority metals, cyanide, and suspended solids above treatable concentrations. Raw wastewater sampling data are presented in Table V-14 (page 2373).

RAW MATERIAL GRANULATION

Raw material may be melted in a furnace and then poured into a container of standing water in order to granulate it. This process is similar to shot casting. The purpose of this operation is to make it easier to dissolve the raw material in the acid dissolution process. Of the 31 plants which hydrometallurgically refine precious metals, four plants granulate the raw material prior to dissolution. Three plants discharge this wastewater, as shown in Table V-2 (page 2361). The fourth plant practices 100 percent recycle of granulation water.

Following proposal, sampling data for this subdivision were acquired through a self-sampling effort specifically requested by the Agency. These data show treatable concentrations of cadmium, lead, silver, palladium, and TSS.

SPENT PLATING SOLUTIONS

Spent or contaminated electroplating solutions with a high precious metal content may be recycled to recover the precious metals value. After recovering this value, the depleted solution may be discharged. Twelve plants recover precious metals from spent plating solutions. Discharge rates for these 12 plants are presented in Table V-3 (page 2362), in liters of wastewater per liter of raw material spent plating solution.

The Agency sampled two plants for this waste stream, and the results are presented in Table V-15 (page 2389). This raw wastewater contains priority metals, free and complexed cyanide, and TSS above treatable concentrations.

SPENT CYANIDE STRIPPING SOLUTIONS

Six plants use sodium or potassium cyanide solutions to strip gold away from electronic scrap and other raw materials. After precipitating the gold, the spent cyanide solution may be discharged. Six plants use this technique as shown in Table V-4 (page 2363). Water use and discharge rates are shown in liters per troy ounce of gold produced by cyanide stripping. Gold production is measured as the product from the precipitation operation.

The Agency sampled one plant for this waste stream, and the results are presented in Table V-16 (page 2399). This waste stream contains priority metals, free and complexed cyanide, and TSS above treatable concentrations.

REFINERY WET AIR POLLUTION CONTROL

All of the acid dissolution vessels, alkaline dissolution vessels, cyanide vessels, and precipitation vessels located in the refinery may be vented to a refinery scrubber. A plant can use acid scrubbers, alkali scrubbers, or both types of scrubbers. Of the 29 plants using emissions control, 26 discharge wastewater. The other three plants practice 100 percent recycle. Seventeen of the 26 discharging plants practice recycle of 90 percent or greater. Table V-5 (page 2364) shows water discharge rates in liters per troy ounce of precious metals, including silver, produced in the refinery.

The Agency sampled the wastewater from four discharging plants, three of which practice recycle of at least 90 percent. This raw wastewater contains priority metals and suspended solids above treatable concentrations. Raw wastewater sampling data are presented in Table V-17 (page 2402).

GOLD SOLVENT EXTRACTION RAFFINATE AND WASH WATER

Gold can be extracted from an impure raw material using an organic solvent and then recovered from the solvent as pure gold. The raffinate generated by this process can be discharged, and one plant discharges this waste stream as shown in Table V-6 (page 2366). After the pure gold is recovered, it is washed with water and this wash water is also discharged.

Following proposal, sampling data for this subdivision were acquired through a self-sampling effort specifically requested by the Agency. These data show treatable concentrations of antimony, cadmium, chromium, copper, lead, nickel, silver, thallium, zinc, ammonia, TSS, gold, palladium, and platinum.

GOLD SPENT ELECTROLYTE

Three plants use electrolytic refining as a purification step in secondary gold processing and discharge the spent electrolyte wastewater associated with this process. Water use and discharge rates are shown in Table V-7 (page 2366). No samples were taken of this waste stream however, the Agency believes it should be similar to gold precipitation and filtration wastewater because of contact with similar raw materials. This wastewater is expected to contain priority metals and TSS above treatable concentrations.

GOLD PRECIPITATION AND FILTRATION

Gold may be recovered by dissolving the raw material in strong acid such as aqua regia, filtering away the silver chloride, and precipitating the gold with a strong reducing agent such as chlorine, ferrous sulfate or sulfur dioxide gas. Gold sponge is recovered by filtering away the wastewater and washing the sponge with water one or more times to remove residual acid. This combined filtrate and wash water waste stream may be discharged via a cementation tank where either zinc or iron is added to recover additional precious metals, and then to treatment. The 28 plants with this waste stream are shown in Table V-8 (page 2367).

The Agency sampled this waste stream at four plants, one prior to cementation, and all four as combined wastewater after cementation. Only the plant sampled prior to cementation is presented in Table V-18 to characterize this raw wastewater because of the metallic replacement reactions and commingling of wastewater taking place in the cementation tank. As shown in Table V-22 (page 2440), the post-cementation data support the general characterization of gold precipitation and filtration wastewater data. Both show high priority metal concentrations, along with ammonia and TSS above treatable concentrations. If a plant cements this wastewater with zinc, the effluent from cementation will contain high zinc concentrations.

PLATINUM PRECIPITATION AND FILTRATION

Platinum may be recovered by dissolving the raw material in acid, filtering away the impurities, and precipitating the platinum as an amine. The insoluble amine (yellow salt) is then separated from the solution by filtration. The filtrate may be combined with wash water, and sent to cementation or treatment. Eighteen plants recover platinum in this manner as shown in Table V-9 (page 2369).

Following proposal, sampling data for this subdivision were acquired through a self-sampling effort specifically requested by the Agency. These data show treatable concentrations of arsenic, cadmium, chromium, copper, lead, nickel, selenium, zinc, and ammonia.

PALLADIUM PRECIPITATION AND FILTRATION

Palladium may be recovered by dissolving the raw material in strong acid or base, filtering away impurities, precipitating the palladium as an amine, and filtering away the solution. The insoluble amine (red salt) may be reduced with a strong reducing agent to the pure metal sponge. The filtrate may be combined with wash water, and sent to cementation or treatment. Twenty plants recover palladium in this manner as shown in Table V-10 (page 2370).

The Agency sampled one of the discharging plants for three palladium batch discharges, as shown in Table V-19 (page 2426). The raw wastewater shows priority metals, ammonia, and TSS above treatable concentrations.

OTHER PLATINUM GROUP METALS PRECIPITATION AND FILTRATION

Three plants use a wet chemistry process similar to the type used to recover either platinum or palladium, to recover other platinum group metals including rhodium and iridium. All three plants discharge wastewater as shown in Table V-11 (page 2371).

Following proposal, sampling data for this subdivision were acquired through a self-sampling effort specifically requested by the Agency. These data show treatable concentrations of antimony, arsenic, cadmium, chromium, copper, lead, nickel, selenium, zinc, and ammonia.

SPENT SOLUTION FROM PGC SALT PRODUCTION

Four plants manufacture potassium gold cyanide (PGC) salt from pure gold and potassium cyanide solution. Excess cyanide solution may be discharged from this process. Water use and discharge rates are shown in Table V-12 (page 2371).

The Agency sampled one plant for this waste stream, and the results are presented in Table V-20 (page 2436). Raw wastewater contains toxic metals, and free and complexed cyanide above treatable concentrations.

EQUIPMENT AND FLOOR WASH

Three plants reported an equipment and floor wash waste stream. This waste stream is discharged via cementation, to treatment. Table V-13 (page 2372) shows water use and discharge rates in liters per troy ounce of Precious metals, including silver, produced in the refinery. The Agency sampled this waste stream at one plant, and the data are presented in Table V-21 (page 2436). This wastewater contains priority metals, ammonia, and TSS above treatable concentrations.

PRELIMINARY TREATMENT

Based on information provided to the Agency after promulgation of the regulation for this subcategory, EPA agreed to add a new building block for the preliminary treatment process. This building block was omitted from the promulgated rule because EPA believed that the processing of basis materials was accounted for by the furnace wet air pollution building block (FWAP). However, subsequent to promulgation, EPA found that the FWAP building block does not reflect the raw material processing steps required for non-combustible, non-metallic-based basis materials. As discussed in Section III, details of the preliminary treatment steps are claimed confidential, therefore water use and discharge rates are not presented in this document.

TABLE V-1

WATER USE AND DISCHARGE RATES FOR FURNACE WET AIR POLLUTION CONTROL

(1/troy ounce of precious metals, including silver, incinerated or smelted)

Plant Code	Percent Recycle	Production Normalized Water Use	Production Normalized Discharge Flow
1081	98.2	7.26	0.131
1038	0	116	116
1138		27.6	27.6
1105	≥90	NR	4.5
1112	0	137	137
1094	100	NR	0
1084	100	NR	0
1095	Dry		
1153	Dry		
1163	Dry		
1020	Dry		
1019	Dry		
1082	Dry		
1134	Dry		
1071	Dry		
1088	Dry		
1051	Dry		
1045	Dry		

NR - Data not reported.

TABLE V-2

WATER USE AND DISCHARGE RATES FOR RAW MATERIAL GRANULATION

(liters/troy ounce of precious metals
in the granulated raw material)

Plant Code	Percent Recycle	Production Normalized Water Use	Production Normalized Discharge Flow
1008	0	8.67	8.67
1094	0	4.0	4.0
1112	0	0.30	0.30
1082	100	Unknown	0

TABLE V-3

WATER USE AND DISCHARGE RATES FOR SPENT PLATING SOLUTIONS

(l/liter of raw material spent plating solution)

Plant Code	Percent Recycle	Production Normalized Water Use	Production Normalized Discharge Flow
1002	0	1.0	1.0
1163	0	1.0	1 0
1094	0	1.0	1.0
1092	0	1.0	1.0
1023	0	1.0	1.0
1128	0	1.0	1.0
1083	0	1.0	1.0
1167	NR	NR	NR
1071	0	1.0	1.0
1034	0	1.0	1.0
1067	0	1.0	1.0
1065	0	1.0	1.0

NR - Data not reported.

TABLE V-4

WATER USE AND DISCHARGE RATES FOR SPENT CYANIDE STRIPPING SOLUTIONS

(l/troy ounce of gold produced by cyanide stripping)

Plant Code	Percent Recycle	Production Normalized Water Use	Production Normalized Discharge Flow
1100	0	78.3	78.3
1034	0	7.63	7.63
1163	0	6.03	6.03
1067	0	2.92	2.92
1083	0	1.14	1.14
1026	0	0.631	0.631

TABLE V-5

WATER USE AND DISCHARGE RATES FOR REFINERY WET AIR POLLUTION CONTROL

(l/troy ounce of precious metals, including silver, produced in refinery)

Plant Code	Percent Recycle	Production Normalized Water Use	Production Normalized Discharge Flow
1100	0	107	107
1117	0	42	42
1029	0	32.8	32.8
1020	≥90	NR	14.2
1051	0	13.2	13.2
1147	75	39.4	9.85
1065	0	6.8	6.8
1067	90	46.4	4.64
1112	0	3.4	3.4
1091	NR	NR	3.32
1071	0	2.4	2.4
1105	≥90	NR	2.3
1080	≥90	NR	1.75
1115	≥90	NR	1.665
1069	≥90	NR	1.41
1008	≥90	NR	1.1
1164	90	7.0	0.7
1083	≥90	NR	0.67
1104	≥90	NR	0.234
1138	≥90	NR	0.21

TABLE V-5 (Continued)

WATER USE AND DISCHARGE RATES FOR REFINERY WET AIR POLLUTION CONTROL

(l/troy ounce of precious metals, including silver,
produced in refinery)

Plant Code	Percent Recycle	Production Normalized Water Use	Production Normalized Discharge Flow
1094	≥90	NR	0.19
1165	≥90	NR	0.172
1082	99	7.2	0.072
1026	≥90	NR	0.06
1072	≥90	NR	0.036
1167	95	0.6	0.03
1053	100	NR	0
1128	100	NR	0
1034	100	NR	0

NR - Data not reported.

TABLE V-6

WATER USE AND DISCHARGE RATES FOR GOLD SOLVENT EXTRACTION RAFFINATE AND WASH WATER

(l/troy ounce of gold produced by solvent extraction)

Plant Code	Percent Recycle	Production Normalized Water Use	Production Normalized Discharge Flow
1094	0	0.63	0.63

TABLE V-7

WATER USE AND DISCHARGE RATES FOR GOLD SPENT ELECTROLYTE

(l/troy ounce of gold produced by electrolysis)

Plant Code	Percent Recycle	Production Normalized Water Use	Production Normalized Discharge Flow
1071	0	0.294	0.294
108?	0	0.0087	0.0087
1088	NR	NR	NR

NR - Data not reported.

TABLE V-8

WATER USE AND DISCHARGE RATES FOR GOLD PRECIPITATION AND FILTRATION WASTEWATER

(l/troy ounce of gold precipitated)

Plant Code	Percent Recycle	Production Normalized Water Use	Production Normalized Discharge Flow
1034	0	560.5	560.5
1100	0	404	404
1091	0	69.1	69.1
1053	0	24.3	24.3
1165	0	7.98	7.98
1083	0	4.1	4.1
1067	0	3.34	3.34
1063	0	2.65	2.65
1082	0	2.5	2.5
1147	0	1.86	1.86
1110	0	0.815	0.815
1008	0	0.63	0.63
1138	0	0.341	0.341
1065	0	0.312	0.312
1117	0	0.27	0.27
1153	0	0.144	0.144
1026	0	0.05	0.05
1020	NR	NR	0
1069	NR	NR	0

TABLE V-8 (Continued)

WATER USE AND DISCHARGE RATES FOR GOLD PRECIPITATION AND FILTRATION WASTEWATER

(l/troy ounce of gold precipitated)

Plant Code	Percent Recycle	Production Normalized Water Use	Production Normalized Discharge Flow
1018	NR	NR	NR
1104	NR	NR	NR
1128	NR	NR	NR
1164	NR	NR	NR
1029	NR	NR	NR
1167	NR	NR	NR
1072	NR	NR	NR
1115	NR	NR	NR
1071	NR	NR	NR

NR - Data not reported.

TABLE V-9

WATER USE AND DISCHARGE RATES FOR PLATINUM PRECIPITATION AND FILTRATION

(l/troy ounce of platinum precipitated)

Plant Code	Percent Recycle	Production Normalized Water Use	Production Normalized Discharge Flow
1020	0	354	354
1082	0	30.2	30.2
1069	0	10.4	10.4
1105	0	4.5	4.5
1147	0	0.58	0.58
1071	NR	NR	NR
1018	NR	NR	NR
1063	NR	NR	NR
1072	NR	NR	NR
1115	NR	NR	NR
1117	NR	NR	NR
1104	NR	NR	NR
1156	NR	NR	NR
1138	NR	NR	NR
1080	NR	NR	NR
1088	NR	NR	NR
1153	NR	NR	NR
1134	NR	NR	NR

NR - Data not reported.

TABLE V-10

WATER USE AND DISCHARGE RATES FOR PALLADIUM PRECIPITATION AND FILTRATION

(l/troy ounce of palladium precipitated)

Plant Code	Percent Recycle	Production Normalized Water Use	Production Normalized Discharge Flow
1069	0	15.8	15.8
1147	0	4.58	4.58
1105	0	4.4	4.4
1112	0	3.9	3.9
1082	0	3.4	3.4
1138	0	1.53	1.53
1020	NR	NR	0
1153	NR	NR	NR
1018	NR	NR	NR
1128	NR	NR	NR
1029	NR	NR	NR
1072	NR	NR	NR
1115	NR	NR	NR
1117	NR	NR	NR
1104	NR	NR	NR
1156	NR	NR	NR
1080	NR	NR	NR
1071	NR	NR	NR
1088	NR	NR	NR
1051	NR	NR	NR

NR - Data not reported.

TABLE V-11

WATER USE AND DISCHARGE RATES FOR OTHER PLATINUM GROUP METALS PRECIPITATION AND FILTRATION

(l/troy ounce of other platinum group metals precipitated)

Plant Code	Percent Recycle	Production Normalized Water Use	Production Normalized Discharge Flow
1115	NR	NR	NR
1051	NR	NR	NR
1156	NR	NR	NR

NR - Data not reported.

TABLE V-12

WATER USE AND DISCHARGE RATES FOR SPENT SOLUTION FROM PGC SALT PRODUCTION

(l/troy ounce of gold contained in PGC product)

Plant Code	Percent Recycle	Production Normalized Water Use	Production Normalized Discharge Flow
1100	0	260	260
1112	0	1.5	1.5
1034	0	0.90	0.90
1128	NR	NR	NR

NR - Data not reported

TABLE V-13

WATER USE AND DISCHARGE RATES FOR EQUIPMENT AND FLOOR WASH

(l/troy ounce of precious metals, including silver. produced in refinery)

Plant Code	Percent RecYcle	Production Normalized Water Use	Production Normalized Discharge Flow
1020	0	14.2	14.2
1105	0	1.0	1.0
1138	0	0.97	0.97

Table V-14

SECONDARY PRECIOUS METALS SAMPLING DATA
FURNACE WET AIR POLLUTION CONTROL
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants						
1. acenaphthene	189	1	ND			ND
	5	2	ND	ND	ND	ND
2. acrolein	189	1	ND			ND
	5	1	ND	ND	ND	ND
3. acrylonitrile	189	1	ND			ND
	5	1	ND	ND	ND	ND
4. benzene	189	1	ND			ND
	5	1	ND	ND	ND	ND
5. benzidine	189	1	ND			ND
	5	2	ND	ND	ND	ND
6. carbon tetrachloride	189	1	ND			ND
	5	1	ND	ND	ND	ND
7. chlorobenzene	189	1	ND			ND
	5	1	ND	ND	ND	<0.010
8. 1,2,4-trichlorobenzene	189	1	ND			ND
	5	2	ND	ND	ND	ND
9. hexachlorobenzene	189	1	ND			ND
	5	2	ND	ND	ND	ND

Table V-14 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
FURNACE WET AIR POLLUTION CONTROL
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l)			
			Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
10. 1,2-dichloroethane	189	1	ND			ND
	5	1	ND	ND	ND	ND
11. 1,1,1-trichloroethane	189	1	0.01			0.015
	5	1	ND	ND	ND	ND
12. hexachloroethane	189	1	ND			ND
	5	2	ND	ND	ND	ND
13. 1,1-dichloroethane	189	1	ND			ND
	5	1	ND	ND	ND	ND
14. 1,1,2-trichloroethane	189	1	ND			ND
	5	1	ND	ND	ND	ND
15. 1,1,2,2-tetrachloroethane	189	1	ND			ND
	5	1	ND	ND	ND	ND
16. chloroethane	189	1	ND			ND
	5	1	ND	ND	ND	ND
17. bis(chloromethyl)ether	189	1	ND			ND
	5	1	ND	ND	ND	ND
18. bis(2-chloroethyl)ether	189	1	ND			ND
	5	2	ND	ND	ND	ND

Table V-14 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
FURNACE WET AIR POLLUTION CONTROL
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
19. 2-chloroethyl vinyl ether	189	1	ND			ND
	5	1	ND	ND	ND	ND
20. 2-chloronaphthalene	189	1	ND			ND
	5	2	ND	ND	ND	ND
2 . 2,4,6-trichlorophenol	189	1	ND			ND
	5	2	ND	ND	ND	ND
22. p-chloro-m-cresol	189	1	ND			ND
	5	2	ND	ND	ND	ND
23. chloroform	189	1	ND			ND
	5	1	0.050	0.010	<0.010	0.020
24. 2-chlorophenol	189	1	ND			ND
	5	2	ND	ND	ND	ND
25. 1,2-dichlorobenzene	189	1	ND			ND
	5	2	ND	ND	ND	ND
26. 1,3-dichlorobenzene	189	1	ND			ND
	5	2	ND	ND	ND	ND
27. 1,4-dichlorobenzene	189	1	ND			ND
	5	2	ND	ND	ND	ND

Table V-14 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
FURNACE WET AIR POLLUTION CONTROL
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l)			
			Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
28. 3,3'-dichlorobenzidine	189	1	ND			ND
	5	2	ND	ND	ND	ND
29. 1,1-dichloroethylene	189	1	ND			ND
	5	1	ND	ND	ND	ND
30. 1,2-*trans*-dichloroethylene	189	1	ND			ND
	5	1	ND	ND	ND	ND
31. 2,4-dichlorophenol	189	1	ND			ND
	5	2	ND	ND	ND	ND
32. 1,2-dichloropropane	189	1	ND			ND
	5	1	ND	ND	ND	ND
33. 1,3-dichloropropene	189	1	ND			ND
	5	1	ND	ND	ND	ND
34. 2,4-dimethylphenol	189	1	ND			ND
	5	2	ND	ND	ND	ND
35. 2,4-dinitrotoluene	189	1	ND			ND
	5	2	ND	ND	ND	ND
36. 2,6-dinitrotoluene	189	1	ND			ND
	5	2	ND	ND	ND	ND

Table V-14 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
FURNACE WET AIR POLLUTION CONTROL
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
37. 1,2-diphenylhydrazine	189	1	ND			ND
	5	2	ND	ND	ND	ND
38. ethylbenzene	189	1	ND			ND
	5	1	ND	ND	ND	ND
39. fluoranthene	189	1	ND			ND
	5	2	ND	ND	ND	ND
40. 4-chlorophenyl phenyl ether	189	1	ND			ND
	5	2	ND	ND	ND	ND
41. 4-bromophenyl phenyl ether	189	1	ND			ND
	5	2	ND	ND	ND	ND
4 . bis(2-chloroisopropyl)ether	189	1	ND			ND
	5	2	ND	ND	ND	ND
4 . bis(2-choroethoxy)methane	189	1	ND			ND
	5	2	ND	ND	ND	ND
44. methylene chloride	189	1	ND			ND
	5	1	<0.01	<0.01	<0.01	<0.01
45. methyl chloride (chloromethane)	189	1	ND			ND
	5	1	ND	ND	ND	ND

Table V-14 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
FURNACE WET AIR POLLUTION CONTROL
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
6. methyl bromide (bromomethane)	189	1	ND			ND
	5	1	ND	ND	ND	ND
47. bromoform (tribromomethane)	189	1	ND			ND
	5	1	ND	ND	ND	ND
48. dichlorobromomethane	189	1	ND			ND
	5	1	<0.01	<0.01	<0.01	ND
49. trichlorofluoromethane	189	1	ND			ND
	5	1	ND	ND	ND	ND
50. dichlorodifluoromethane	189	1	ND			ND
	5	1	ND	ND	ND	ND
51. chlorodibromomethane	189	1	ND			ND
	5	1	ND	ND	ND	ND
52. hexachlorobutadiene	189	1	ND			ND
	5	2	ND	ND	ND	ND
53. hexachlorocyclopentadiene	189	1	ND			ND
	5	2	ND	ND	ND	ND
54. isophorone	189	1	ND			ND
	5	2	ND	ND	ND	ND

Table V-14 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
FURNACE WET AIR POLLUTION CONTROL
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l)			
			Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
55. naphthalene	189	1	ND			ND
	5	2	ND	ND	ND	ND
56. nitrobenzene	189	1	ND			ND
	5	2	ND	ND	ND	ND
57. 2-nitrophenol	189	1	ND			ND
	5	2	ND	ND	ND	ND
58. 4-nitrophenol	189	1	ND			ND
	5	2	ND	ND	ND	ND
59. 2,4-dinitrophenol	189	1	ND			ND
	5	2	ND	ND	ND	ND
60. 4,6-dinitro-o-cresol	189	1	ND			ND
	5	2	ND	ND	ND	ND
61. N-nitrosodimethylamine	189	1	ND			ND
	5	2	ND	ND	ND	ND
62. N-nitrosodiphenylamine	189	1	ND			0.01
	5	2	ND	ND	ND	ND
63. N-nitrosodi-n-propylamine	189	1	ND			ND
	5	2	ND	ND	ND	ND

Table V-14 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
FURNACE WET AIR POLLUTION CONTROL
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l)			
			Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
64. pentachlorophenol	189	1	ND			ND
	5	2	ND	ND	ND	ND
65. phenol	189	1	ND			0.013
	5	2	ND	<0.01	<0.01	ND
66. bis(2-ethylhexyl) phthalate	189	1	0.026			0.034
	5	2	0.02	<0.01	<0.01	<0.01
67. butyl benzyl phthalate	189	1	ND			ND
	5	2	ND	ND	ND	ND
68. di-n-butyl phthalate	189	1	ND			0.002
	5	2	<0.01	<0.01	<0.01	<0.01
69. di-n-octyl phthalate	189	1	ND			0.003
	5	2	ND	ND	ND	ND
70. diethyl phthalate	189	1	ND			ND
	5	2	<0.01	<0.01	<0.01	<0.01
71. dimethyl phthalate	189	1	ND			0.006
	5	2	ND	ND	ND	ND
72. benzo(a)anthracene	189	1	ND			ND
	5	2	ND	ND	ND	ND

Table V-14 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
FURNACE WET AIR POLLUTION CONTROL
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
73. benzo(a)pyrene	189	1	ND			ND
	5	2	ND	ND	ND	ND
74. benzo(b)fluoranthene	189	1	ND			ND
	5	2	ND	ND	ND	ND
75. benzo(k)fluoranthane	189	1	ND			ND
	5	2	ND	ND	ND	ND
76. chrysene	189	1	ND			ND
	5	2	ND	ND	ND	ND
77. acenaphthylene	189	1	ND			ND
	5	2	ND	ND	ND	ND
78. anthracene (a)	189	1	ND			ND
	5	2	ND	ND	ND	ND
79. benzo(ghi)perylene	189	1	ND			ND
	5	2	ND	ND	ND	ND
80. fluorene	189	1	ND			ND
	5	2	ND	ND	ND	ND
81. phenanthrene (a)	189	1	ND			ND
	5	2	ND	ND	ND	ND

Table V-14 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
FURNACE WET AIR POLLUTION CONTROL
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
xic Pollutants (Continued)						
2. dibenzo(a,h)anthracene	189	1	ND			ND
	5	2	ND	ND	ND	ND
83. indeno (1,2,3-c,d)pyrene	189	1	ND			ND
	5	2	ND	ND	ND	ND
84. pyrene	189	1	ND			ND
	5	2	ND	ND	ND	ND
85. tetrachloroethylene	189	1	ND			ND
	5	1	ND	ND	ND	ND
86. toluene	189	1	ND			ND
	5	1	ND	ND	ND	ND
87. trichloroethylene	189	1	ND			ND
	5	1	ND	ND	ND	ND
88. vinyl chloride (chloroethylene)	189	1	ND			ND
	5	1	ND	ND	ND	ND
114. antimony	200	2	<0.01		<0.01	
	189	1	<0.003			0.19
	5	2	<0.003	0.004	<0.003	<0.003

Table V-14 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
FURNACE WET AIR POLLUTION CONTROL
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
115. arsenic	200	2	<0.01		<0.01	
	189	1	<0.003			0.025
	5	2	<0.005	0.004	<0.005	0.005
117. beryllium	200	2	<0.01		<0.01	
	189	1	<0.01			<0.01
	5	2	<0.0002	0.0006	<0.0002	<0.0002
118. cadmium	200	2	<0.05		<0.05	
	189	1	<0.01			0.61
	5	2	0.0002	0.001	0.020	0.003
119. chromium (total)	200	2	<0.05		<0.05	
	189	1	<0.01			1.1
	5	2	0.003	0.003	0.001	0.003
120. copper	200	2	<0.05		0.05	
	189	1	<0.01			11.0
	5	2	0.017	0.026	0.140	0.040
121. cyanide (total)	200	1	0.05		0.095	
	189	1	<0.02			<0.02
	5	1	0.052	0.008	0.090	0.150
122. lead	200	2	<0.10		<0.10	
	189	1	<0.10			3.0
	5	2	0.030	0.037	0.80	0.092

Table V-14 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
FURNACE WET AIR POLLUTION CONTROL
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
123. mercury	200	2	0.0002		0.015	
	189	1	0.002			<0.0002
	5	2	0.0002	0.0003	<0.0001	<0.0001
124. nickel	200	2	<0.2		<0.2	
	189	1	0.075			30.0
	5	2	0.020	0.017	0.016	0.014
125. selenium	200	2	<0.1A		<0.1A	
	189	1	<0.003			0.007
	5	2	<0.002	120.0	<0.002	<0.002
126. silver	200	2	<0.01		0.05	
	189	1	<0.0005			0.13
	5	2	<0.0002	0.001	0.003	0.004
127. thallium	200	2	<0.01		<0.01	
	189	1	<0.002			<0.002
	5	2	<0.001	<0.001	0.004	<0.30
128. zinc	200	2	0.10		0.150	
	189	1	2.5			1,100
	5	2	<0.010	0.110	0.190	0.160

Table V-14 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
FURNACE WET AIR POLLUTION CONTROL
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Nonconventional Pollutants						
acidity	200	2	<1		<1	
	189	1	<1			<1
alkalinity	200	2	98		75	
	189	1	127			91
	5	2	16	31	0	33
aluminum	200	2	0.20		0.3	
	189	1	<0.050			8.3
ammonia nitrogen	200	2	0.04		0.24	
	189	1	<0.01			<0.01
barium	200	2	<0.050		<0.05	
	189	1	0.070			0.37
boron	200	1	<0.10		<0.10	
	189	1	<0.009			2.1
calcium	200	2	37.7		38.4	
	189	1	11			710
	5	2	13	9.9	14	9.7
chemical oxygen demand (COD)	200	2	<5		100	
	189	1				490

Table V-14 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
FURNACE WET AIR POLLUTION CONTROL
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l)			
			Source	Day 1	Day 2	Day 3
Nonconventional Pollutants (Continued)						
chloride	200	2	14		63	
	189	1	52			1,000
cobalt	200	2	<0.050		<0.05	
	189	1	<0.006			2.4
fluoride	200	2	0.28		0.21	
	189	1	1.1			1.8
gold	5	1	0.025	0.086	0.48	0.42
iron	200	2	<0.050		0.2	
	189	1	0.31			104
	5	2	0.29	0.32	0.52	0.51
magnesium	200	1	8.50		8.6	
	189	1	2.4			15
	5	1	3.1	3.2	3.4	3.2
manganese	200	2	<0.050		<0.05	
	189	1	<0.01			1.2
molybdenum	200	2	<0.050		<0.05	
	189	1	<0.002			0.061
phenolics	5	1	0.15	0.25	0.061	0.005

Table V-14 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
FURNACE WET AIR POLLUTION CONTROL
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Nonconventional Pollutants (Continued)						
phosphate	200	2	14		<0.9	
	189	1				<4
sodium	200	2	9		13.3	
	189	1	54			8,100
sulfate	200	2	57		27	
	189	1	13			920
tin	200	2	<0.050		<0.05	
	189	1	<0.12			<0.12
titanium	200	2	<0.005		<0.05	
	189	1	<0.005			<0.005
total organic carbon (TOC)	200	2	4.3		4	
	189	1	43			94
total solids (TS)	200	2	380		6,000	
	189	1	410			35,000
vanadium	200	2	<0.050		<0.05	
	189	1	<0.003			<0.003

Table V-14 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
FURNACE WET AIR POLLUTION CONTROL
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Nonconventional Pollutants (Continued)						
yttrium	200	2	<0.50		<0.05	
	189	1	<0.002			0.004
Conventional Pollutants						
oil and grease	200	1	<1		2	
	189	1	<1			<1
	5	1	1.6	<1	<1	<1
total suspended solids (TSS)	200	2	60		5,600	
	189	1	8			1,100
	5	2	0	0	8	13
pH (standard units)	200	2	7.5		7.3	
	189	1	7.36			5.96
	5	2	6.8	6.6	3.4	7.1

†Sample Type Code: 1 - One-time grab
2 - Manual composite during intermittent process operation

(a) Reported together.

A - Detection limit raised due to interference.

Table V-15

SECONDARY PRECIOUS METALS SAMPLING DATA
SPENT PLATING SOLUTIONS
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants						
acenaphthene	6	1	ND	ND	ND	ND
2 acrolein	6	1	ND	ND	ND	ND
3. acrylonitrile	6	1	ND	ND	ND	ND
4. benzene	6	1	ND	ND	<0.01	ND
5. benzidine	6	1	ND	ND	ND	ND
6. carbon tetrachloride	6	1	ND	ND	ND	ND
7. chlorobenzene	6	1	ND	ND	ND	ND
8. 1,2,4-trichlorobenzene	6	1	ND	ND	ND	ND
9. hexachlorobenzene	6	1	ND	ND	ND	ND
10. 1,2-dichloroethane	6	1	ND	ND	ND	ND
11. 1,1,1-trichloroethane	6	1	ND	ND	ND	ND
12. hexachloroethane	6	1	ND	ND	ND	ND
13. 1,1-dichloroethane	6	1	ND	ND	ND	ND
14. 1,1,2-trichloroethane	6	1	ND	ND	ND	ND

Table V-15 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
SPENT PLATING SOLUTIONS
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
15. 1,1,2,2-tetrachloroethane	6	1	ND	ND	ND	ND
16. chloroethane	6	1	ND	ND	ND	ND
17. bis(chloromethyl)ether	6	1	ND	ND	ND	ND
18. bis(2-chloroethyl)ether	6	1	ND	ND	ND	ND
19. 2-chloroethyl vinyl ether	6	1	ND	ND	ND	ND
20. 2-chloronaphthalene	6	1	ND	ND	ND	ND
21. 2,4,6-trichlorophenol	6	1	ND	ND	ND	ND
22. p-chloro-m-cresol	6	1	ND	ND	ND	ND
23. chloroform	6	1	ND	ND	ND	ND
24. 2-chlorophenol	6	1	ND	<0.01	ND	ND
25. 1,2-dichlorobenzene	6	1	ND	ND	ND	ND
26. 1,3-dichlorobenzene	6	1	ND	ND	ND	ND
27. 1,4-dichlorobenzene	6	1	ND	ND	ND	ND
28. 3,3'-dichlorobenzidine	6	1	ND	ND	ND	ND

Table V-15 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
SPENT PLATING SOLUTIONS
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l)			
			Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
29. 1,1-dichloroethylene	6	1	ND	ND	ND	ND
30. 1,2-trans-dichloroethylene	6	1	ND	ND	ND	ND
31. 2,4-dichlorophenol	6	1	ND	ND	ND	ND
32. 1,2-dichloropropane	6	1	ND	ND	ND	ND
33. 1,3-dichloropropene	6	1	ND	ND	ND	ND
34. 2,4-dimethylphenol	6	1	ND	<0.01	ND	ND
35. 2,4-dinitrotoluene	6	1	ND	ND	ND	ND
36. 2,6-dinitrotoluene	6	1	ND	ND	ND	ND
37. 1,2-diphenylhydrazine	6	1	ND	ND	ND	ND
38. ethylbenzene	6	1	ND	ND	ND	ND
39. fluoranthene	6	1	ND	ND	ND	ND
40. 4-chlorophenyl phenyl ether	6	1	ND	ND	ND	ND
41. 4-bromophenyl phenyl ether	6	1	ND	ND	ND	ND
42. bis(2-chloroisopropyl)ether	6	1	ND	ND	ND	ND

Table V-15 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
SPENT PLATING SOLUTIONS
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
43. bis(2-choroethoxy)methane	6	1	ND	ND	ND	ND
44. methylene chloride	6	1	<0.01	<0.01	<0.01	<0.01
45. methyl chloride (chloromethane)	6	1	ND	ND	ND	ND
46. methyl bromide (bromomethane)	6	1	ND	ND	ND	ND
47. bromoform (tribromomethane)	6	1	ND	ND	ND	ND
48. dichlorobromomethane	6	1	ND	ND	ND	ND
49. trichlorofluoromethane	6	1	ND	ND	ND	ND
50. dichlorodifluoromethane	6	1	ND	ND	ND	ND
51. chlorodibromomethane	6	1	ND	ND	ND	ND
52. hexachlorobutadiene	6	1	ND	ND	ND	ND
53. hexachlorocyclopentadiene	6	1	ND	ND	ND	ND
54. isophorone	6	1	ND	ND	ND	ND
55. naphthalene	6	1	ND	ND	ND	ND
56. nitrobenzene	6	1	ND	ND	ND	ND

Table V-15 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
SPENT PLATING SOLUTIONS
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
oxic Pollutants (Continued)						
57. 2-nitrophenol	6	1	ND	ND	0.01	<0.01
58. 4-nitrophenol	6	1	ND	ND	ND	ND
59. 2,4-dinitrophenol	6	1	ND	ND	ND	ND
60. 4,6-dinitro-o-cresol	6	1	ND	ND	ND	ND
61. N-nitrosodimethylamine	6	1	ND	ND	ND	ND
62. N-nitrosodiphenylamine	6	1	ND	ND	ND	ND
63. N-nitrosodi-n-propylamine	6	1	ND	ND	ND	ND
64. pentachlorophenol	6	1	ND	ND	ND	ND
65. phenol	6	1	ND	0.17	0.45	0.65
66. bis(2-ethylhexyl) phthalate	6	1	0.02	0.06	0.10	0.02
67. butyl benzyl phthalate	6	1	ND	ND	ND	ND
68. di-n-butyl phthalate	6	1	<0.01	<0.01	<0.01	ND
69. di-n-octyl phthalate	6	1	ND	ND	ND	ND
70. diethyl phthalate	6	1	<0.01	<0.01	<0.01	<0.01

Table V-15 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
SPENT PLATING SOLUTIONS
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l)			
			Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
71. dimethyl phthalate	6	1	ND	ND	ND	ND
72. benzo(a)anthracene	6	1	ND	ND	ND	ND
73. benzo(a)pyrene	6	1	ND	ND	ND	ND
74. benzo(b)fluoranthene	6	1	ND	ND	ND	ND
75. benzo(k)fluoranthane	6	1	ND	ND	ND	ND
76. chrysene	6	1	ND	ND	ND	ND
77. acenaphthylene	6	1	ND	ND	ND	ND
78. anthracene (a)	6	1	ND	ND	ND	ND
79. benzo(ghi)perylene	6	1	ND	ND	ND	ND
80. fluorene	6	1	ND	ND	ND	ND
81. phenanthrene (a)	6	1	ND	ND	ND	ND
82. dibenzo(a,h)anthracene	6	1	ND	ND	ND	ND
83. indeno (1,2,3-c,d)pyrene	6	1	ND	ND	ND	ND
84. pyrene	6	1	ND	ND	ND	ND

Table V-15 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
SPENT PLATING SOLUTIONS
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
oxic Pollutants (Continued)						
85. tetrachloroethylene	6	1	ND	ND	ND	ND
36. toluene	6	1	ND	<0.01	<0.01	<0.01
87. trichloroethylene	6	1	ND	ND	ND	ND
38. vinyl chloride (chloroethylene)	6	1	ND	ND	ND	ND
4. antimony	6	1	<0.003	3.5	1.0	5.2
	701	1	<0.003	<0.003		
115. arsenic	6	1	<0.005	0.25	2.2	1.0
	701	1	<0.002	<0.003		
117. beryllium	6	1	<0.0002	0.09	0.46	0.17
	701	1	0.002	0.005		
118. cadmium	6	1	0.0002	0.74	1.6	0.48
	701	1	0.014	0.12		
119. chromium (total)	6	1	0.003	20.0	22.0	14.0
	701	1	0.015	0.14		
chromium (hexavalent)	701	1		<0.02		

Table V-15 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
SPENT PLATING SOLUTIONS
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
oxic Pollutants (Continued)						
20. copper	6	1	0.017	12.0	340.0	130.0
	701	1	2.3	5.7		
21. cyanide (total)	6	1	0.052	170.0	11.0	25.0
	701	1	0.41	100		
cyanide (free)	701	1	0.26	29		
122. lead	6	1	0.03	3.4	9.7	2.1
	701	1	<0.08	<0.084		
123. mercury	6	1	0.0002	<0.0001	<0.0001	<0.0002
	701	1	0.0007	0.0004		
124. nickel	6	1	0.02	56.0	700.0	1.8
	701	1	0.25	1.1		
125. selenium	6	1	<0.002	<0.002	<0.002	<0.002
	701	1	<0.002	0.18		
126. silver	6	1	<0.0002	0.26	0.27	0.28
	701	1	<0.0005	<0.0005		
127. thallium	6	1	<0.001	1.2	0.91	0.90
	701	1	<0.002	<0.002		

Table V-15 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
SPENT PLATING SOLUTIONS
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l)			
			Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
128. zinc	6	1	<0.01	9,600	10,000	810
	701	1	0.055	<0.003		
Nonconventional Pollutants						
alkalinity	6	1	16	66,000	39,000	12,000
aluminum	701	1	0.86	2,100		
barium	701	1	0.056	0.012		
boron	701	1	<0.009	<0.009		
calcium	6	1	13	2.2	7.6	4.4
	701	1	4.2	2.1		
cobalt	701	1	0.044	2.1		
gold	6	1	0.025	5.2	40	5.4
	701	1	0.15	15		
iron	6	1	0.29	4.7	6.0	0.53
	701	1	0.94	9.3		
magnesium	6	1	3.1	6.8	1.6	0.47
	701	1	1.3	0.99		
manganese	701	1	0.013	0.043		

Table V-15 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
SPENT PLATING SOLUTIONS
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Nonconventional Pollutants (Continued)						
molybdenum	701	1	0.029	<0.002		
phenolics	6	1	0.15	0.02	0.07	0.37
sodium	701	1	13	1,500		
tin	701	1	<0.12	<0.12		
tanium	701	1	0.12	0.13		
anadium	701	1	0.073	0.094		
trium	701	1	<0.002	<0.002		
nventional Pollutants						
l and grease	6	1	1.6	<1		<1
otal suspended solids	6	1		600	1,200	520
pH (standard units)	6	1	6.8	12.0	12.3	12.4
	701	1	7	10		

†Sample Type Code: 1 - One-time grab

(a) Reported together.

Table V-16

SECONDARY PRECIOUS METALS SAMPLING DATA
SPENT CYANIDE STRIPPING SOLUTION
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants						
114. antimony	702	1	<0.003	<0.003		
115. arsenic	702	1	<0.002	0.11		
117. beryllium	702	1	0.002	2.4		
118. cadmium	702	1	0.014	7.6		
119. chromium (total)	702	1	0.015	0.12		
120. copper	702	1	2.3	5,000		
121. cyanide (total)	702	1	0.41	9,897		
cyanide (free)	702	1	0.26	40		
122. lead	702	1	<0.08	<0.08		
123. mercury	702	1	0.0007	0.0004		
124. nickel	702	1	0.25	890		
125. selenium	702	1	<0.002	0.18		
126. silver	702	1	<0.0005	<0.0005		
127. thallium	702	1	<0.002	<0.002		
128. zinc	702	1	0.055	56		

Table V-16 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
SPENT CYANIDE STRIPPING SOLUTION
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Nonconventional Pollutants						
aluminum	702	1	0.86	280		
barium	702	1	0.056	0.072		
boron	702	1	<0.009	<0.009		
calcium	702	1	4.2	0.42		
cobalt	702	1	0.044	73		
gold	702	1	0.15	8.9		
iron	702	1	0.94	23		
magnesium	702	1	1.3	0.19		
manganese	702	1	0.013	0.045		
molybdenum	702	1	0.029	12		
sodium	702	1	13	2,500		
tin	702	1	<0.12	<0.12		
titanium	702	1	0.12	0.59		
vanadium	702	1	0.073	0.51		
yttrium	702	1	<0.002	<0.002		

Table V-16 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
SPENT CYANIDE STRIPPING SOLUTION
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Conventional Pollutants						
pH (standard units)	702	1	7	10		

†Sample Type Code: 1 - One-time grab

Table V-17

SECONDARY PRECIOUS METALS SAMPLING DATA
REFINERY WET AIR POLLUTION CONTROL
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants						
1. acenaphthene	187	1	ND			ND
	4	2	ND	ND	ND	ND
	821	1		ND		
. acrolein	187	1	ND			ND
	4	1	ND	ND	ND	ND
	821	1		ND		
. acrylonitrile	187	1	ND			ND
	4	1	ND	ND	ND	ND
	821	1		ND		
4. benzene	187	1	ND			ND
	4	1	ND	<0.01	ND	ND
	821	1		ND		
5. benzidine	187	1	ND			ND
	4	2	ND	ND	ND	ND
	821	1		ND		
6. carbon tetrachloride	187	1	ND			0.210
	4	1	ND	ND	ND	ND
	821	1		ND		
7. chlorobenzene	187	1	ND			ND
	4	1	ND	ND	ND	ND
	821	1		ND		

Table V-17 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
REFINERY WET AIR POLLUTION CONTROL
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
8. 1,2,4-trichlorobenzene	187	1	ND			ND
	4	2	ND	ND	ND	ND
	821	1		ND		
9. hexachlorobenzene	187	1	ND			ND
	4	2	ND	ND	ND	ND
	821	1		ND		
10. 1,2-dichloroethane	187	1	ND			ND
	4	1	ND	ND	ND	<0.01
	821	1		ND		
11. 1,1,1-trichloroethane	187	1	0.01			ND
	4	1	ND	ND	ND	ND
	821	1		ND		
12. hexachloroethane	187	1	ND			ND
	4	2	ND	ND	ND	ND
	821	1		ND		
13. 1,1-dichloroethane	187	1	ND			ND
	4	1	ND	ND	ND	ND
	821	1		ND		
14. 1,1,2-trichloroethane	187	1	ND			ND
	4	1	ND	ND	ND	ND
	821	1		ND		

Table V-17 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
REFINERY WET AIR POLLUTION CONTROL
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
15. 1,1,2,2-tetrachloroethane	187	1	ND			ND
	4	1	ND	ND	ND	ND
	821	1		ND		
16. chloroethane	187	1	ND			ND
	4	1	ND	ND	ND	ND
	821	1		ND		
17. bis(chloromethyl)ether	187	1	ND			ND
	4	1	ND	ND	ND	ND
	821	1		ND		
18. bis(2-chloroethyl)ether	187	1	ND			ND
	4	2	ND	ND	ND	ND
	821	1		ND		
19. 2-chloroethyl vinyl ether	187	1	ND			ND
	4	2	ND	ND	ND	ND
	821	1		ND		
20 2-chloronaphthalene	187	1	ND			ND
	4	2	ND	ND	ND	ND
	821	1		ND		
21. 2,4,6-trichlorophenol	187	1	ND			ND
	4	2	ND	ND	ND	ND
	821	1		<0.01		

Table V-17 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
REFINERY WET AIR POLLUTION CONTROL
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
22. p-chloro-m-cresol	187	1	ND			ND
	4	2	ND	ND	ND	ND
	821	1		ND		
23. chloroform	187	1	ND			ND
	4	1	0.05	0.02	0.02	0.02
	821	1		ND		
24. 2-chlorophenol	187	1	ND			ND
	4	2	ND	ND	ND	ND
	821	1		ND		
25. 1,2-dichlorobenzene	187	1	ND			ND
	4	2	ND	ND	ND	ND
	821	1		ND		
26. 1,3-dichlorobenzene	187	1	ND			ND
	4	2	ND	ND	ND	ND
	821	1		ND		
27. 1,4-dichlorobenzene	187	1	ND			ND
	4	2	ND	ND	ND	ND
	821	1		ND		
28. 3,3'-dichlorobenzidine	187	1	ND			ND
	4	2	ND	ND	ND	ND
	821	1		ND		

Table V-17 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
REFINERY WET AIR POLLUTION CONTROL
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
xic Pollutants (Continued)						
. 1,1-dichloroethylene	187	1	ND			ND
	4	1	ND	ND	ND	ND
	821	1		ND		
0. 1,2-trans-dichloroethylene	187	1	ND			ND
	4	1	ND	ND	ND	ND
	821	1		ND		
31. 2,4-dichlorophenol	187	1	ND			ND
	4	2	ND	ND	ND	ND
	821	1		ND		
32. 1,2-dichloropropane	187	1	ND			ND
	4	1	ND	ND	ND	ND
	821	1		ND		
33. 1,3-dichloropropene	187	1	ND			ND
	4	1	ND	ND	ND	ND
	821	1		ND		
34. 2,4-dimethylphenol	187	1	ND			ND
	4	2	ND	ND	ND	ND
	821	1		ND		
35. 2,4-dinitrotoluene	187	1	ND			ND
	4	2	ND	ND	ND	ND
	821	1		ND		

Table V-17 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
REFINERY WET AIR POLLUTION CONTROL
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
36. 2,6-dinitrotoluene	187	1	ND			ND
	4	2	ND	ND	ND	ND
	821	1		ND		
37. 1,2-diphenylhydrazine	187	1	ND			ND
	4	2	ND	ND	ND	ND
	821	1		ND		
38. ethylbenzene	187	1	ND			ND
	4	1	ND	ND	ND	ND
	821	1		ND		
39. fluoranthene	187	1	ND			ND
	4	2	ND	ND	ND	ND
	821	1		ND		
40. 4-chlorophenyl phenyl ether	187	1	ND			ND
	4	2	ND	ND	ND	ND
	821	1		ND		
41. 4-bromophenyl phenyl ether	187	1	ND			ND
	4	2	ND	ND	ND	ND
	821	1		ND		
42. bis(2-chloroisopropyl)ether	187	1	ND			ND
	4	2	ND	ND	ND	ND
	821	1		ND		

Table V-17 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
REFINERY WET AIR POLLUTION CONTROL
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
43. bis(2-chloroethoxy)methane	187	1	ND			ND
	4	2	ND	ND	ND	ND
	821	1		ND		
44. methylene chloride	187	1	ND			ND
	4	1	<0.01	<0.01	<0.01	<0.01
	821	1		ND		
5. methyl chloride (chloromethane)	187	1	ND			ND
	4	1	ND	ND	ND	ND
	821	1		ND		
6. methyl bromide (bromomethane)	187	1	ND			ND
	4	1	ND	ND	ND	ND
	821	1		ND		
7. bromoform (tribromomethane)	187	1	ND			ND
	4	1	ND	<0.01	ND	ND
	821	1		ND		
48. dichlorobromomethane	187	1	ND			ND
	4	1	ND	ND	ND	ND
	821	1		ND		
49. trichlorofluoromethane	187	1	ND			ND
	4	1	ND	ND	ND.	ND
	821	1		ND		

Table V-17 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
REFINERY WET AIR POLLUTION CONTROL
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l)			
			Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
0. dichlorodifluoromethane	187	1	ND			ND
	4	1	ND	ND	ND	ND
	821	1		ND		
51. chlorodibromomethane	187	1	ND			ND
	4	1	<0.01	<0.01	ND	ND
	821	1		ND		
2. hexachlorobutadiene	187	1	ND			ND
	4	2	ND	ND	ND	ND
	821	1		ND		
53. hexachlorocyclopentadiene	187	1	ND			ND
	4	2	ND	ND	ND	ND
	821	1		ND		
54. isophorone	187	1	ND			ND
	4	2	ND	<0.01	ND	ND
	821	1		ND		
55. naphthalene	187	1	ND			ND
	4	2	ND	ND	ND	ND
	821	1		ND		
56. nitrobenzene	187	1	ND			ND
	4	2	ND	ND	ND	ND
	821	1		ND		

Table V-17 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
REFINERY WET AIR POLLUTION CONTROL
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
57. 2-nitrophenol	187	1	ND			ND
	4	2	ND	<0.01	<0.01	<0.01
	821	1		ND		
58. 4-nitrophenol	187	1	ND			ND
	4	2	ND	ND	ND	ND
	821	1		ND		
59. 2,4-dinitrophenol	187	1	ND			ND
	4	2	ND	ND	ND	ND
	821	1		ND		
60. 4,6-dinitro-o-cresol	187	1	ND			ND
	4	2	ND	ND	ND	ND
	821	1		ND		
61. N-nitrosodimethylamine	187	1	ND			ND
	4	2	ND	ND	ND	ND
	821	1		ND		
62. N-nitrosodiphenylamine	187	1	ND			ND
	4	2	ND	ND	ND	ND
	821	1		ND		
63. N-nitrosodi-n-propylamine	187	1	ND			ND
	4	2	ND	ND	ND	ND
	821	1		ND		

Table V-17 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
REFINERY WET AIR POLLUTION CONTROL
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
64. pentachlorophenol	187	1	ND			ND
	4	2	ND	ND	ND	ND
	821	1		ND		
65. phenol	187	1	ND			ND
	4	2	ND	<0.01	<0.01	ND
	821	1		ND		
66. bis(2-ethylhexyl) phthalate	187	1	0.026			0.033
	4	2	0.02	<0.01	<0.01	<0.01
	821	1		0.073		
67. butyl benzyl phthalate	187	1	ND			ND
	4	2	ND	ND	ND	ND
	821	1		ND		
68. di-n-butyl phthalate	187	1	ND			0.002
	4	2	<0.01	<0.01	<0.01	ND
	821	1		<0.01		
9. di-n-octyl phthalate	187	1	ND			ND
	4	2	ND	ND	ND	ND
	821	1		ND		
0. diethyl phthalate	187	1	ND			ND
	4	2	<0.01	<0.01	<0.01	<0.01
	821	1		<0.01		

Table V-17 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
REFINERY WET AIR POLLUTION CONTROL
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
71. dimethyl phthalate	187	1	ND			ND
	4	2	ND	ND	ND	ND
	821	1		ND		
72. benzo(a)anthracene	187	1	ND			ND
	4	2	ND	ND	ND	ND
	821	1		ND		
73. benzo(a)pyrene	187	1	ND			ND
	4	2	ND	ND	ND	ND
	821	1		ND		
74. benzo(b)fluoranthene	187	1	ND			ND
	4	2	ND	ND	ND	ND
	821	1		ND		
75. benzo(k)fluoranthane	187	1	ND			ND
	4	2	ND	ND	ND	ND
	821	1		ND		
76. chrysene	187	1	ND			ND
	4	2	ND	ND	ND	ND
	821	1		ND		
77. acenaphthylene	187	1	ND			ND
	4	2	ND	ND	ND	ND
	821	1		ND		

Table V-17 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
REFINERY WET AIR POLLUTION CONTROL
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
78. anthracene (a)	187	1	ND			ND
	4	2	ND	ND	ND	ND
	821	1		ND		
79. benzo(ghi)perylene	187	1	ND			ND
	4	2	ND	ND	ND	ND
	821	1		ND		
80. fluorene	187	1	ND			ND
	4	2	ND	ND	ND	ND
	821	1		ND		
81. phenanthrene (a)	187	1	ND			ND
	4	2	ND	ND	ND	ND
	821	1		ND		
82. dibenzo(a,h)anthracene	187	1	ND			ND
	4	2	ND	ND	ND	ND
	821	1		ND		
83. indeno (1,2,3-c,d)pyrene	187	1	ND			ND
	4	2	ND	ND	ND	ND
	821	1		ND		
84. pyrene	187	1	ND			ND
	4	2	ND	ND	ND	ND
	821	1		ND		

Table V-17 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
REFINERY WET AIR POLLUTION CONTROL
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
85. tetrachloroethylene	187	1	ND			ND
	4	1	ND	ND	ND	ND
	821	1		ND		
86. toluene	187	1	ND			ND
	4	1	ND	<0.01	<0.01	<0.01
	821	1		<0.01		
87. trichloroethylene	187	1	ND			ND
	4	1	ND	ND	ND	ND
	821	1		ND		
88. vinyl chloride (chloroethylene)	187	1	ND			ND
	4	2	ND	ND	ND	ND
	821	1		ND		
114. antimony	201	2	<0.01	1.8	3.2	
	187	1	<0.003			0.32
	4	2	<0.003	<0.003	<0.003	<0.003
	821	1		1.7		
115. arsenic	201	2	<0.01	2.4	0.6	
	187	1	<0.003			0.12
	4	2	<0.005	0.027	<0.005	<0.005
	821	1		0.061		

Table V-17 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
REFINERY WET AIR POLLUTION CONTROL
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
117. beryllium	201	2	<0.01	<0.01	<0.01	
	187	1	<0.01			<0.01
	4	2	<0.0002	0.001	<0.0002	<0.0002
	821	1		<0.001		
118. cadmium	201	2	<0.05	<0.05	<0.05	
	187	1	<0.01			<0.01
	4	2	0.0002	0.001	0.001	0.001
	821	1		4.4		
119. chromium (total)	201	2	<0.05	0.75	0.70	
	187	1	<0.01			<0.01
	4	2	0.003	0.012	0.003	0.004
	821	1		0.012		
120. copper	201	2	<0.05	2.3	2.7	
	187	1	<0.01			0.15
	4	2	0.017	0.016	0.038	0.017
121. cyanide (total)	201	1	0.05	0.37	0.15	
	187	1	<0.02			<0.02
	4	1	0.052	0.930	0.840	0.98
	821	1		0.29		

Table V-17 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
REFINERY WET AIR POLLUTION CONTROL
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
122. lead	201	2	<0.10	0.1	0.2	
	187	1	<0.10			<0.10
	4	2	0.030	0.020	0.050	0.250
	821	1		2.7		
123. mercury	201	2	0.0002	<0.0002	<0.0002	
	187	1	0.002			<0.0002
	4	2	0.0002	<0.0001	<0.0001	<0.0001
	821	1		<0.001		
124. nickel	201	2	<0.20	1.8	2.0	
	187	1	0.075			0.43
	4	2	0.020	0.009	0.008	0.018
	821	1		4.6		
125. selenium	201	2	<0.10A	B	<0.1A	
	187	1	<0.003			0.019
	4	2	<0.002	7.0	<0.002	<0.002
	821	1		7.4		
126. silver	201	2	<0.01	1.9	1.6	
	187	1	<0.0005			0.18
	4	2	<0.0002	0.003	0.002	0.001
	821	1		0.53		

Table V-17 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
REFINERY WET AIR POLLUTION CONTROL
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
127. thallium	201	2	<0.01	B	B	
	187	1	<0.002			<0.002
	4	2	<0.001	<0.001	<0.004	<0.004
	821	1		0.82		
128. zinc	201	2	0.10	1.8	2.5	
	187	1	2.5			6.9
	4	2	<0.010	0.59	0.26	0.39
	821	1		2.3		
Nonconventional Pollutants						
acidity	201	2	<1	960	<1	
	187	1	<1			<1
alkalinity	201	2	98	<1	47	
	187	1	127			93,000
	4	2	16	280	360	330
aluminum	201	2	0.2	<10	<10	
	187	1	<0.05			<0.05
ammonia nitrogen	201	2	0.04	4	6.5	
	187	1	<0.01			<0.01
	821	1		12		

Table V-17 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
REFINERY WET AIR POLLUTION CONTROL
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Nonconventional Pollutants (Continued)						
barium	201	2	<0.05	<5	<5	
	187	1	0.07			0.042
boron	201	2	<0.10	<10	<10	
	187	1	<0.009			<0.009
calcium	201	2	37.7	40	40	
	187	1	11			49
	4	2	13	13	15	13
chemical oxygen demand (COD)	201	2	<5	1,800	16,000	
	187	1				1,100
chloride	201	2	14	69,000	80,000	
	187	1	52			1,200
cobalt	201	2	<0.05	<5	<5	
	187	1	<0.006			<0.006
fluoride	201	2	0.28	1.9	1.6	
	187	1	1.1			1.3
gold	4	2	0.025	0.48	0.42	0.42
iron	201	2	<0.05	8	6.5	
	187	1	0.31			6.2
	4	2	0.29	0.39	0.26	0.30
	821	1		5.2		

Table V-17 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
REFINERY WET AIR POLLUTION CONTROL
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Nonconventional Pollutants (Continued)						
magnesium	201	2	8.50	<10	10	
	187	1	2.4			4.3
	4	2	3.1	3.1	4.4	3.1
manganese	201	2	<0.05	0.1	0.1	
	187	1	<0.01			0.06
molybdenum	201	2	<0.05	<5	<5	
	187	1	<0.002			<0.002
phenolics	4	1	0.15	0.089	0.067	<0.001
	821	1		0.05		
phosphate	201	2	14	5	<0.9	
	187	1				<4
sodium	201	2	9.0	53,000	65,000	
	187	1	54			72,000
sulfate	201	2	57	7,000	15,000	
	187	1	13			260
tin	201	2	<0.05	59.4	74.9	
	187	1	<0.12			<0.12

Table V-17 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
REFINERY WET AIR POLLUTION CONTROL
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
nconventional Pollutants (Continued)						
titanium	201	2	<0.005	<5	<5	
	187	1	<0.005			<0.005
total organic carbon (TOC)	201	2	4.3	20	29	
	187	1	43			80
total solids (TS)	201	2	380	140,000	180,000	
	187	1	410			27,000
vanadium	201	2	<0.05	<5	<5	
	187	1	<0.003			<0.003
yttrium	201	2	<0.05	<5	<5	
	187	1	<0.002			<0.002
Conventional Pollutants						
oil and grease	201	1	<1	3.5	14	
	187	1	<1			<1
	4	1	1.6	<1	<1	<1
	821	1		37		

Table V-17 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
REFINERY WET AIR POLLUTION CONTROL
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Conventional Pollutants (Continued)						
Total suspended solids (TSS)	201	2	60	5,500	390	
	187	1	8			690
	4	2	0	90	14	21
pH (standard units)	201	2	7.5	1.6	8.5	
	187	1	7.36			12.59
	4	2	6.8	10.9	11.9	10.9

†Sample Type Code: 1 - One-time grab
2 - Manual composite during intermittent process operation

( ) Reported together.

A - Detection limit raised due to interference.

B - Chemical interference.

Table V-18

SECONDARY PRECIOUS METALS SAMPLING DATA
GOLD PRECIPITATION AND FILTRATION
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants						
114. antimony	233	1	<0.010		<0.50A	
115. arsenic	233	1	<0.010		<0.20	
117. beryllium	233	1	<0.010		0.150	
118. cadmium	233	1	<0.050		0.10	
119. chromium (total)	233	1	<0.050		3.40	
120. copper	233	1	<0.050		100.0	
121. cyanide (total)	233	1	0.05		<0.02	
122. lead	233	1	<0.10		6.5	
123. mercury	233	1	0.0002		<0.0002	
124. nickel	233	1	<0.20		46.0	
125. selenium	233	1	<0.10A		B	
126. silver	233	1	<0.010		26.0	
127. thallium	233	1	<0.010		<0.5A	
128. zinc	233	1	0.10		340.0	

Table V-18 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
GOLD PRECIPITATION AND FILTRATION
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Nonconventional Pollutants						
acidity	233	1	<1		<1	
alkalinity	233	1	98		850	
aluminum	233	1	0.20		109	
ammonia nitrogen	233	1	0.04		570	
barium	233	1	<0.050		<0.5	
boron	233	1	<0.10		<1.0	
calcium	233	1	37.7		44.0	
chemical oxygen demand (COD)	233	1	<5		37,000	
chloride	233	1	14		16,000	
cobalt	233	1	<0.050		1.0	
fluoride	233	1	0.28		0.65	
iron	233	1	<0.050		10.0	
magnesium	233	1	8.50		10.0	
manganese	233	1	<0.050		0.30	

Table V-18 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
GOLD PRECIPITATION AND FILTRATION
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l)			
			Source	Day 1	Day 2	Day 3
Nonconventional Pollutants (Continued)						
molybdenum	233	1	<0.050		2.0	
phosphate	233	1	14		130	
sodium	233	1	9		2,390	
sulfate	233	1	57		30,000	
tin	233	1	<0.050		<0.5	
titanium	233	1	<0.050		<0.5	
total organic carbon (TOC)	233	1	4.3		140	
total solids (TS)	233	1	380		240,000	
vanadium	233	1	<0.050		<0.5	
yttrium	233	1	<0.50		<0.5	
Conventional Pollutants						
oil and grease	233	1	<1		3	

Table V-18 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
GOLD PRECIPITATION AND FILTRATION
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l)			
			Source	Day 1	Day 2	Day 3
Conventional Pollutants (Continued)						
total suspended solids (TSS)	233	1	60		1,670	
pH (standard units)	233	1	7.5		9.3	

†Sample Type Code: 1 - One-time grab

[2] - Detection limit raised due to interference.

[3] - Chemical interference.

Table V-19

SECONDARY PRECIOUS METALS SAMPLING DATA
PALLADIUM PRECIPITATION AND FILTRATION
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants						
114. antimony	230	1	<0.01	0.50		
	230	1	<0.01		<0.50A	
	230	1	<0.01		<0.20A	
115. arsenic	230	1	<0.01	<0.2A		
	230	1	<0.01		<0.01	
	230	1	<0.01		0.07	
117 beryllium	230	1	<0.01	<0.01		
	230	1	<0.01		0.02	
	230	1	<0.01		0.02	
118. cadmium	230	1	<0.05	0.05		
	230	1	<0.05		0.25	
	230	1	<0.05		0.4	
119. chromium (total)	230	1	<0.05	1.2		
	230	1	<0.05		1.8	
	230	1	<0.05		0.65	
120. copper	230	1	<0.05	300.0		
	230	1	<0.05		72.0	
	230	1	<0.05		72.0	
121. cyanide (total)	230	1	0.05	<0.02		
	230	1	0.05		<0.02	
	230	1	0.05		<0.02	

Table V-19 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
PALLADIUM PRECIPITATION AND FILTRATION
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
122. lead	230	1	<0.10	1.8		
	230	1	<0.10		6.8	
	230	1	<0.10		6.2	
123. mercury	230	1	0.0002	<0.0002		
	230	1	0.0002		<0.0002	
	230	1	0.0002		<0.0002	
124. nickel	230	1	<0.2	30.0		
	230	1	<0.2		8.0	
	230	1	<0.2		8.8	
125. selenium	230	1	<0.1A	B		
	230	1	<0.1A		<0.1A	
	230	1	<0.1A		<0.1A	
126. silver	230	1	<0.01	9.4		
	230	1	<0.01		10.0	
	230	1	<0.01		1.8	
127. thallium	230	1	<0.01	<0.1A		
	230	1	<0.01		<0.01	
	230	1	<0.01		<0.04A	
128. zinc	230	1	0.10	170		
	230	1	0.10		180	
	230	1	0.10		270	

Table V-19 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
PALLADIUM PRECIPITATION AND FILTRATION
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Nonconventional Pollutants						
acidity	230	1	<1	2,500		
	230	1	<1		9,000	
	230	1	<1		9,500	
alkalinity	230	1	98	<1		
	230	1	98		<1	
	230	1	98		<1	
aluminum	230	1	0.2	<1		
	230	1	0.2		23.3	
	230	1	0.2		9.8	
ammonia nitrogen	230	1	0.04	5,060		
	230	1	0.04		1.4	
	230	1	0.04		2,700	
barium	230	1	<0.05	<0.5		
	230	1	<0.05		<0.05	
	230	1	<0.05		<0.05	
boron	230	1	<0.1	<1		
	230	1	<0.1		1.4	
	230	1	<0.1		0.5	
calcium	230	1	37.7	10		
	230	1	37.7		33	
	230	1	37.7		18.3	

Table V-19 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
PALLADIUM PRECIPITATION AND FILTRATION
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Nonconventional Pollutants (Continued)						
chemical oxygen demand (COD)	230	1	<5	34,000		
	230	1	<5		24,000	
	230	1	<5		40,000	
chloride	230	1	14	10,000		
	230	1	14		12,000	
	230	1	14		41,000	
cobalt	230	1	<0.05	<0.5		
	230	1	<0.05		0.3	
	230	1	<0.05		0.4	
fluoride	230	1	0.28	0.28		
	230	1	0.28		0.8	
	230	1	0.28		0.37	
iron	230	1	<0.05	4.8		
	230	1	<0.05		21	
	230	1	<0.05		31	
magnesium	230	1	8.5	2		
	230	1	8.5		9	
	230	1	8.5		4	

Table V-19 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
PALLADIUM PRECIPITATION AND FILTRATION
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Nonconventional Pollutants (Continued)						
manganese	230	1	<0.05	0.1		
	230	1	<0.05		0.3	
	230	1	<0.05		0.3	
molybdenum	230	1	<0.050	<0.5		
	230	1	<0.050		0.7	
	230	1	<0.050		0.6	
phosphate	230	1	14	<4		
	230	1	14		<1	
	230	1	14		<1	
sodium	230	1	9.00	54		
	230	1	9.00		25.7	
	230	1	9.00		160	
sulfate	230	1	57	5,500		
	230	1	57		200,000	
	230	1	57		2,700	
tin	230	1	<0.050	3.4		
	230	1	<0.050		18.4	
	230	1	<0.050		5.6	

Table V-19 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
PALLADIUM PRECIPITATION AND FILTRATION
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Nonconventional Pollutants (Continued)						
titanium	230	1	<0.050	<0.5		
	230	1	<0.050		0.25	
	230	1	<0.050		0.4	
total organic carbon (TOC)	230	1	4.3	2,700		
	230	1	4.3		34	
	230	1	4.3		2,600	
total solids (TS)	230	1	380	170,000		
	230	1	380		250,000	
	230	1	380		55,000	
vanadium	230	1	<0.050	<0.5		
	230	1	<0.050		<0.05	
	230	1	<0.050		<0.05	
yttrium	230	1	<0.50	<0.5		
	230	1	<0.50		<0.05	
	230	1	<0.50		<0.05	

Table V-19 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
PALLADIUM PRECIPITATION AND FILTRATION
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Conventional Pollutants						
oil and grease	230	1	<1	2		
	230	1	<1		<1	
	230	1	<1		5	
total suspended solids (TSS)	230	1	60	200		
	230	1	60		630	
	230	1	60		210	
pH (standard units)	230	1	7.5	1.6		
	230	1	7.5		0.1	
	230	1	7.5		0.2	

†Sample Type Code: 1 - One-time grab

A - Detection limit raised due to interference.

B · Chemical interference.

Table V-20

SECONDARY PRECIOUS METALS SAMPLING DATA
SPENT SOLUTION FROM PGC SALT PRODUCTION
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants						
4. antimony	703	1	<0.003	<0.003		
arsenic	703	1	<0.002	<0.003		
7. beryllium	703	1	0.002	0.006		
118. cadmium	703	1	0.014	0.037		
119. chromium (total)	703	1	0.015	0.32		
120. copper	703	1	2.3	5.9		
121. cyanide (total)	703	1	0.41	5,000		
cyanide (free)	703	1	0.26	42		
122. lead	703	1	<0.08	0.33		
123. mercury	703	1	0.0007	<0.0002		
124. nickel	703	1	0.25	0.61		
125. selenium	703	1	<0.002	<0.003		
126. silver	703	1	<0.0005	<0.0005		
127. thallium	703	1	<0.002	<0.002		
128. zinc	703	1	0.055	0.98		

Table V-20 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
SPENT SOLUTION FROM PGC SALT PRODUCTION
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Nonconventional Pollutants						
aluminum	703	1	0.86	4.0		
barium	703	1	0.056	<0.001		
boron	703	1	<0.009	0.67		
calcium	703	1	4.2	2.6		
cobalt	703	1	0.044	0.11		
gold	703	1	0.15	1.4		
iron	703	1	0.94	27		
magnesium	703	1	1.3	0.77		
manganese	703	1	0.013	0.041		
molybdenum	703	1	0.029	0.1		
sodium	703	1	13	520		
tin	703	1	<0.12	<0.12		
titanium	703	1	0.12	0.84		
vanadium	703	1	0.073	0.18		
yttrium	703	1	<0.002	0.06		

Table V-20 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
SPENT SOLUTION FROM PGC SALT PRODUCTION
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l)			
			Source	Day 1	Day 2	Day 3
Conventional Pollutants						
pH (standard units)	703	1	7	10		

†Sample Type Code: 1 - One-time grab

Table V-21

SECONDARY PRECIOUS METALS SAMPLING DATA
EQUIPMENT AND FLOOR WASH
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants						
114. antimony	228	1	<0.01	0.08	0.06	
115. arsenic	228	1	<0.01	<0.05A	<0.05A	
117. beryllium	228	1	<0.01	<0.01	<0.01	
118. cadmium	228	1	<0.05	0.6	0.1	
119. chromium (total)	228	1	<0.05	1.1	0.35	
120. copper	228	1	<0.05	280.0	21.0	
121. cyanide (total)	228	1	<0.05	0.13	0.11	
122. lead	228	1	<0.10	8.0	1.3	
123. mercury	228	1	0.0002	<0.0002	<0.0002	
124. nickel	228	1	<0.20	12.0	1.8	
125. selenium	228	1	<0.1A	<0.1A	<0.1A	
126. silver	228	1	<0.01	0.26	0.09	
127. thallium	228	1	<0.01	<0.05A	<0.01	
128. zinc	228	1	0.10	440.0	9.2	

Table V-21 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
EQUIPMENT AND FLOOR WASH
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Nonconventional Pollutants						
acidity	228	1		1,080	<1	
alkalinity	228	1	98	<1	360	
aluminum	228	1	0.20	5.5	4.9	
ammonia nitrogen	228	1	0.04	120	75	
barium	228	1	<0.050	<0.05	<0.05	
boron	228	1	<0.10	0.2	0.2	
calcium	228	1	37.7	43.7	34.2	
chemical oxygen demand (COD)	228	1	<5	37,000	6,200	
chloride	228	1	14	<1	490	
cobalt	228	1	<0.050	0.45	0.05	
fluoride	228	1	0.28	0.47	0.4	
iron	228	1	<0.050	39.8	12.0	
magnesium	228	1	8.50	9.3	7.9	
manganese	228	1	<0.050	0.3	0.15	

Table V-21 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
EQUIPMENT AND FLOOR WASH
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Nonconventional Pollutants (Continued)						
molybdenum	228	1	<0.050	0.05	0.45	
phosphate	228	1	14	<4	<1	
sodium	228	1	9	44	478	
sulfate	228	1	57	2,900	3,000	
tin	228	1	<0.050	7.55	3.3	
titanium	228	1	<0.050	<0.05	<0.5	
total organic carbon (TOC)	228	1	4.3	15	15	
total solids (TS)	228	1	380	120	2,600	
vanadium	228	1	<0.050	<0.05	<0.05	
yttrium	228	1	<0.50	<0.05	<0.05	
Conventional Pollutants						
oil and grease	228	1	<1	2	6	

Table V-21 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
EQUIPMENT AND FLOOR WASH
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l)			
			Source	Day 1	Day 2	Day 3
Conventional Pollutants (Continued)						
total suspended solids (TSS)	228	1	60	20	760	
pH (standard units)	228	1	7.5	1.8	10.9	

Sample Type Code: 1 - One-time grab

- Detection limit raised due to interference.

- Chemical interference.

Table V-22

SECONDARY PRECIOUS METALS SAMPLING DATA
CEMENTATION TANK EFFLUENT

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l)			
			Source	Day 1	Day 2	Day 3
Toxic Pollutants						
. acenaphthene	185	1	ND		ND	
	3	3	ND	ND	ND	ND
	822	1	ND	ND		
2. acrolein	185	1	ND		ND	
	3	1	ND	ND	ND	ND
	822	1	ND	ND		
3. acrylonitrile	185	1	ND		ND	
	3	1	ND	ND	ND	ND
	822	1	ND	ND		
4. benzene	185	1	ND		ND	
	3	1	ND	ND	ND	ND
	822	1	ND	ND		
5. benzidine	185	1	ND		ND	
	3	3	ND	ND	ND	ND
	822	1	ND	ND		
6. carbon tetrachloride	185	1	ND		ND	
	3	1	ND	ND	ND	ND
	822	1	ND	ND		
7. chlorobenzene	185	1	ND		ND	
	3	3	ND	ND	ND	ND
	822	1	ND	ND		

Table V-22 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
CEMENTATION TANK EFFLUENT

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
8. 1,2,4-trichlorobenzene	185	1	ND		ND	
	3	3	ND	ND	ND	ND
	822	1	ND	ND		
9. hexachlorobenzene	185	1	ND		ND	
	3	3	ND	ND	ND	ND
	822	1	ND	ND		
10. 1,2-dichloroethane	185	1	ND		ND	
	3	1	ND	ND	ND	ND
	822	1	ND	ND		
11. 1,1,1-trichloroethane	185	1	0.01		ND	
	3	1	ND	ND	ND	ND
	822	1	ND	ND		
12. hexachloroethane	185	1	ND		ND	
	3	3	ND	ND	ND	ND
	822	1	ND	ND		
13. 1,1-dichloroethane	185	1	ND		ND	
	3	1	ND	ND	ND	ND
	822	1	ND	ND		
14. 1,1,2-trichloroethane	185	1	ND		ND	
	3	1	ND	ND	ND	ND
	822	1	ND	ND		

Table V-22 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA CEMENTATION TANK EFFLUENT

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
15. 1,1,2,2-tetrachloroethane	185	1	ND		ND	
	3	1	ND	ND	ND	ND
	822	1	ND	ND		
16. chloroethane	185	1	ND		ND	
	3	1	ND	ND	ND	ND
	822	1	ND	ND		
17. bis(chloromethyl)ether	185	1	ND		ND	
	3	1	ND	ND	ND	ND
	822	1	ND	ND		
18. bis(2-chloroethyl)ether	185	1	ND		ND	
	3	3	ND	ND	ND	ND
	822	1	ND	ND		
19. 2-chloroethyl vinyl ether	185	1	ND		ND	
	3	1	ND	ND	ND	ND
	822	1	ND	ND		
20. 2-chloronaphthalene	185	1	ND		ND	
	3	3	ND	<0.01	ND	ND
	822	1	ND	ND		
21. 2,4,6-trichlorophenol	185	1	ND		ND	
	3	3	ND	0.020	0.030	0.020
	822	1	ND	ND		

Table V-22 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
CEMENTATION TANK EFFLUENT

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
22. p-chloro-m-cresol	185	1	ND		ND	
	3	3	ND	ND	ND	ND
	822	1	ND	ND		
23. chloroform	185	1	ND		ND	
	3	1	0.050	<0.010	<0.01	<0.01
	822	1	ND	ND		
24. 2-chlorophenol	185	1	ND		ND	
	3	3	ND	<0.01	<0.01	<0.01
	822	1	ND	ND		
25. 1,2-dichlorobenzene	185	1	ND		ND	
	3	3	ND	ND	ND	ND
	822	1	ND	ND		
26. 1,3-dichlorobenzene	185	1	ND		ND	
	3	3	ND	ND	ND	ND
	822	1	ND	ND		
27. 1,4-dichlorobenzene	185	1	ND		ND	
	3	3	ND	ND	ND	ND
	822	1	ND	ND		
28. 3,3'-dichlorobenzidine	185	1	ND		ND	
	3	3	ND	ND	ND	ND
	822	1	ND	ND		

Table V-22 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
CEMENTATION TANK EFFLUENT

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
xic Pollutants (Continued)						
29. 1,1-dichloroethylene	185	1	ND		ND	
	3	1	ND	ND	ND	ND
	822	1	ND	ND		
30. ,2-trans-dichloroethylene	185	1	ND		ND	
	3	1	ND	ND	ND	ND
	822	1	ND	ND		
31. 2,4-dichlorophenol	185	1	ND		ND	
	3	3	ND	0.030	0.030	0.020
	822	1	ND	ND		
32. 1,2-dichloropropane	185	1	ND		ND	
	3	1	ND	ND	ND	ND
	822	1	ND	ND		
33. 1,3-dichloropropene	185	1	ND		ND	
	3	1	ND	ND	ND	ND
	822	1	ND	ND		
34. 2,4-dimethylphenol	185	1	ND		ND	
	3	3	ND	ND	ND	ND
	822	1	ND	ND		
35. 2,4-dinitrotoluene	185	1	ND		ND	
	3	3	ND	ND	ND	ND
	822	1	ND	ND		

Table V-22 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
CEMENTATION TANK EFFLUENT

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
36. 2,6-dinitrotoluene	185	1	ND		ND	
	3	3	ND	ND	ND	ND
	822	1	ND	ND		
37. 1,2-diphenylhydrazine	185	1	ND		ND	
	3	3	ND	ND	ND	ND
	822	1	ND	ND		
38. ethylbenzene	185	1	ND		ND	
	3	1	ND	ND	ND	ND
	822	1	ND	ND		
39. fluoranthene	185	1	ND		ND	
	3	3	ND	ND	ND	ND
	822	1	ND	ND		
40. 4-chlorophenyl phenyl ether	185	1	ND		ND	
	3	3	ND	ND	ND	ND
	822	1	ND	ND		
41. 4-bromophenyl phenyl ether	185	1	ND		ND	
	3	3	ND	ND	ND	ND
	822	1	ND	ND		
42. bis(2-chloroisopropyl)ether	185	1	ND		ND	
	3	3	ND	ND	ND	ND
	822	1	ND	ND		

Table V-22 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
CEMENTATION TANK EFFLUENT

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
43. bis(2-chloroethoxy)methane	185	1	ND		ND	
	3	3	ND	ND	ND	ND
	822	1	ND	ND		
44. methylene chloride	185	1	ND		ND	
	3	1	<0.01	ND	0.010	<0.01
	822	1	ND	0.040		
45. methyl chloride (chloromethane)	185	1	ND		ND	
	3	1	ND	ND	ND	ND
	822	1	ND	ND		
46. methyl bromide (bromomethane)	185	1	ND		ND	
	3	1	ND	ND	ND	ND
	822	1	ND	ND		
47. bromoform (tribromomethane)	185	1	ND		ND	
	3	1	ND	ND	ND	ND
	822	1	ND	ND		
48. dichlorobromomethane	185	1	ND		ND	
	3	1	<0.01	<0.01	<0.01	<0.01
	822	1	ND	ND		
49. trichlorofluoroemthane	185	1	ND		ND	
	3	1	ND	ND	ND	ND
	822	1	ND	ND		

Table V-22 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
CEMENTATION TANK EFFLUENT

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
ic Pollutants (Continued)						
. dichlorodifluoromethane	185	1	ND		ND	
	3	1	ND	ND	ND	ND
	822	1	ND	ND		
. chlorodibromomethane	185	1	ND		ND	
	3	1	ND	ND	ND	ND
	822	1	ND	ND		
. hexachlorobutadiene	185	1	ND		ND	
	3	3	ND	ND	ND	ND
	822	1	ND	ND		
3. hexachlorocyclopentadiene	185	1	ND		ND	
	3	3	ND	ND	ND	ND
	822	1	ND	ND		
54. isophorone	185	1	ND		ND	
	3	3	ND	ND	ND	ND
	822	1	ND	ND		
55. naphthalene	185	1	ND		ND	
	3	3	ND	<0.01	ND	ND
	822	1	ND	ND		
56. nitrobenzene	185	1	ND		ND	
	3	3	ND	ND	ND	ND
	822	1	ND	ND		

Table V-22 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
CEMENTATION TANK EFFLUENT

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l)			
			Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
57. 2-nitrophenol	185	1	ND		ND	
	3	3	ND	ND	ND	ND
	822	1	ND	ND		
58. 4-nitrophenol	185	1	ND		ND	
	3	3	ND	0.040	ND	ND
	822	1	ND	ND		
59. 2,4-dinitrophenol	185	1	ND		ND	
	3	3	ND	ND	ND	ND
	822	1	ND	ND		
60. 4,6-dinitro-o-cresol	185	1	ND		ND	
	3	3	ND	ND	ND	ND
	822	1	ND	ND		
61. N-nitrosodimethylamine	185	1	ND		ND	
	3	3	ND	ND	ND	ND
	822	1	ND	ND		
62. N-nitrosodiphenylamine	185	1	ND		ND	
	3	3	ND	ND	ND	ND
	822	1	ND	ND		
63. N-nitrosodi-n-propylamine	185	1	ND		ND	
	3	3	ND	<0.01	ND	ND
	822	1	ND	ND		

Table V-22 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
CEMENTATION TANK EFFLUENT

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
64. pentachlorophenol	185	1	ND		ND	
	3	3	ND	<0.01	<0.01	<0.01
	822	1	ND	ND		
65. phenol	185	1	ND		0.041	
	3	3	ND	0.020	0.010	<0.01
	822	1	ND	ND		
66. bis(2-ethylhexyl) phthalate	185	1	0.026		0.007	
	3	3	0.020	0.040	0.030	0.040
	822	1	ND	<0.010		
67. butyl benzyl phthalate	185	1	ND		ND	
	3	3	ND	ND	ND	ND
	822	1	ND	ND		
68. di-n-butyl phthalate	185	1	ND		0.002	
	3	3	<0.01	<0.01	<0.01	ND
	822	1	ND	<0.010		
69. di-n-octyl phthalate	185	1	ND		ND	
	3	3	ND	ND	ND	ND
	822	1	ND	ND		
70. diethyl phthalate	185	1	ND		ND	
	3	3	<0.01	<0.01	<0.01	<0.01
	822	1	ND	ND		

Table V-22 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
CEMENTATION TANK EFFLUENT

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
71. dimethyl phthalate	185	1	ND		ND	
	3	3	ND	ND	ND	ND
	822	1	ND	ND		
72. benzo(a)anthracene	185	1	ND		ND	
	3	3	ND	ND	ND	ND
	822	1	ND	ND		
73. benzo(a)pyrene	185	1	ND		ND	
	3	3	ND	ND	ND	ND
	822	1	ND	ND		
74. benzo(b)fluoranthene	185	1	ND		ND	
	3	3	ND	ND	ND	ND
	822	1	ND	ND		
75. benzo(k)fluoranthane	185	1	ND		ND	
	3	3	ND	ND	ND	ND
	822	1	ND	ND		
76. chrysene	185	1	ND		ND	
	3	3	ND	ND	ND	ND
	822	1	ND	ND		
77. acenaphthylene	185	1	ND		ND	
	3	3	ND	ND	ND	ND
	822	1	ND	ND		

Table V-22 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
CEMENTATION TANK EFFLUENT

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
78 anthracene (a)	185	1	ND		ND	
	3	3	ND	ND	ND	ND
	822	1	ND	ND		
79. benzo(ghi)perylene	185	1	ND		ND	
	3	3	ND	ND	ND	ND
	822	1	ND	ND		
80. fluorene	185	1	ND		ND	
	3	3	ND	ND	ND	ND
	822	1	ND	ND		
81. phenanthrene (a)	185	1	ND		ND	
	3	3	ND	ND	ND	ND
	822	1	ND	ND		
82. dibenzo(a,h)anthracene	185	1	ND		ND	
	3	3	ND	ND	ND	ND
	822	1	ND	ND		
83. indeno (1,2,3-c,d)pyrene	185	1	ND		ND	
	3	3	ND	ND	ND	ND
	822	1	ND	ND		
84. pyrene	185	1	ND		ND	
	3	3	ND	ND	ND	ND
	822	1	ND	ND		

Table V-22 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
CEMENTATION TANK EFFLUENT

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
5. tetrachloroethylene	185	1	ND		ND	
	3	1	ND	ND	ND	ND
	822	1	ND	ND		
86. toluene	185	1	ND		ND	
	3	1	ND	<0.01	<0.01	<0.01
	822	1	ND	0.046		
87. trichloroethylene	185	1	ND		ND	
	3	1	ND	<0.01	<0.01	<0.01
	822	1	ND	ND		
88. vinyl chloride (chloroethylene)	185	1	ND		ND	
	3	1	ND	ND	ND	ND
	822	1	ND	ND		
114. antimony	203	2	<0.01		1.70	0.340
	185	1	<0.003		0.26	
	3	3	<0.003	0.13	0.55	1.2
	822	1		0.21		
15. arsenic	203	2	<0.010		<0.20A	<0.20A
	185	1	<0.003		0.068	
	3	3	<0.005	0.095	0.190	0.140
	822	1		0.19		

Table V-22 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
CEMENTATION TANK EFFLUENT

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
117. beryllium	203	2	<0.010		0.36	0.05
	185	1	<0.01		<0.01	
	3	3	<0.0002	1.4	1.32	1.9
	822	1		0.012		
118. cadmium	203	2	<0.050		28.0	16.0
	185	1	<0.01		3.4	
	3	3	0.0002	6	5.8	8.8
	822	1		0.21		
119. chromium (total)	203	2	<0.050		25.0	2.8
	185	1	<0.01		11.1	
	3	3	0.0003	31.0	15.0	19.0
	822	1		<0.001		
120. copper	203	2	<0.050		1,800	150.0
	185	1	<0.01		55.0	
	3	3	0.017	220	210	320
	822	1		14		
121. cyanide (total)	203	1	0.05		<0.02	<0.02
	185	1	<0.02		<0.02	
	3	1	0.052	<0.001	<0.0001	<0.001
	822	1		0.67		

Table V-22 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
CEMENTATION TANK EFFLUENT

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
122. lead	203	2	<0.10		490.0	90.0
	185	1	<0.10		10	
	3	3	0.020	100	80	110
	822	1		5.0		
123. mercury	203	2	0.0002		<0.0002	<0.0002
	185	1	0.002		<0.0002	
	3	3	0.0002	0.013	<0.0001	<0.0001
	822	1		0.003		
124. nickel	203	2	<0.10A		470.0	22.0
	185	1	0.075		220	
	3	3	0.020	110	80	110
	822	1		0.95		
125. selenium	203	2	<0.10A		B	B
	185	1	<0.003		0.007	
	3	3	<0.002	64	<0.002	<0.002
	822	1		2.2		
126. silver	203	2	<0.010		4.90	14.0
	185	1	<0.0005		0.96	
	3	3	<0.0002	1.4	3.9	0.0013
	822	1		0.34		

Table V-22 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
CEMENTATION TANK EFFLUENT

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
127. thallium	203	2	<0.010		B	B
	185	1	<0.002		<0.002	
	3	3	<0.001	0.310	0.400	0.730
	822	1		0.51		
128. zinc	203	2	0.100		34,000	22,000
	185	1	2.5		4,500	
	3	3	<0.010	3,400	2,800	3,400
	822	1		1.0		
Nonconventional Pollutants						
acidity	203	2			8,000	930
	185	1	<1		85	
alkalinity	203	2	98		<1	<1
	185	1	127		<1	
	3	3	16			
aluminum	203	2	0.20		1,070.0	50.0
	185	1	<0.050		44	
ammonia nitrogen	203	2	0.04		3,300	8.5
	185	1	<0.01		980	
	822	1		340		

Table V-22 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
CEMENTATION TANK EFFLUENT

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Nonconventional Pollutants (Continued)						
barium	203	2	<0.050		<5.0	<5.0
	185	1	0.070		1.9	
boron	203	2	<0.10		10.0	<10.0
	185	1	<0.009		35	
calcium	203	2	37.7		80.0	50.0
	185	1	11		150	
	3	3	15	16	19	20
chemical oxygen demand (COD)	203	2	<5		20,000	>50,000
	185	1				
chloride	203	2	14		78,000	11,000
	185	1	52		56,000	
cobalt	203	2	<0.050		15.0	<5
	185	1	<0.006		14.5	
fluoride	203	2	0.28		5.0	1.1
	185	1	1.1		3.1	
gold	3	3	0.025	2.9	4.4	4.2
iron	203	2	<0.050		790.0	160.0
	185	1	0.31		825	
	3	3	0.29	2,100	1,900	2,600
	822	1		5,400		

Table V-22 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
CEMENTATION TANK EFFLUENT

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Nonconventional Pollutants (Continued)						
magnesium	203	2	8.50		100.0	20.0
	185	1	2.4		28	
	3	3	3.1	33	34	56
manganese	203	2	<0.050		6.60	1.40
	185	1	<0.01		6.2	
molybdenum	203	2	<0.050		10.0	<5.0
	185	1	<0.002		0.89	
phenolics	3	1	0.015	0.78	0.44	0.51
	822	1		0.092		
phosphate	203	2	14			210
	185	1				
sodium	203	2	9.00		2,090.0	940.0
	185	1	54		20,000	
sulfate	203	2	57		82,000	41,000
	185	1	13		195	
tin	203	2	<0.050		54.9	9.9
	185	1	<0.12		<0.12	

Table V-22 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
CEMENTATION TANK EFFLUENT

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
onconventional Pollutants (Continued)						
titanium	203	2	<0.050		125.0	<5.0
	185	1	<0.005		0.16	
total organic carbon (TOC)	203	2	4.3		450	590
	185	1	43		166	
total solids (TS)	203	2	380		17,000	120,000
	185	1	410		77,000	
vanadium	203	2	<0.050		<5.0	<5.0
	185	1	<0.003		0.090	
yttrium	203	2	<0.50		<5.0	<5.0
	185	1	<0.002		0.012	
Conventional Pollutants						
oil and grease	203	1	<1		4	3
	185	1	<1		<1	
	3	1	1.6	33	35	14
	822	1		30		

Table V-22 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
CEMENTATION TANK EFFLUENT

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l)			
			Source	Day 1	Day 2	Day 3
Conventional Pollutants (Continued)						
total suspended solids (TSS)	203	2	60		570	70
	185	1	8		895	
	3	3		48	100	61
pH (standard units)	203	2	7.5		0.40	1.00
	185	1	7.36		3.75	
	3	3	6.8	0.3	0.5	1.2

†Sample Type Code:
1 - One-time grab
2 - Manual composite during intermittent process operation
3 - 8-hour manual composite

(a) Reported together.

A - Detection limit raised due to interference.

B - Chemical interference.

Table V-23

SECONDARY PRECIOUS METALS SAMPLING DATA
TREATMENT PLANT SAMPLES - PLANT A

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
xic Pollutants						
4. antimony	209	5	<0.01	<0.40A	0.40	0.120
	212	5	<0.01	<0.20A	<0.50A	<0.50A
	215	5	<0.01	<0.50A	0.18	<0.01
	218	5	<0.01	<0.20A	<0.01	<0.20A
	221	5	<0.01	<0.50A	<0.20A	<0.20A
	224	6	<0.01	<0.01	<0.20A	0.390
5. arsenic	209	5	<0.01	0.04	0.06	0.03
	212	5	<0.01	<0.05A	<0.05A	<0.05A
	215	5	<0.01	<0.05A	<0.10A	<0.05A
	218	5	<0.01	<0.10A	<0.10A	<0.10A
	221	5	<0.01	<0.20A	<0.20A	<0.20A
	224	6	<0.01	<0.40A	<0.05A	<0.05A
7. beryllium	209	5	<0.01	0.01	0.10	0.05
	212	5	<0.01	0.01	0.05	0.07
	215	5	<0.01	0.01	0.05	0.07
	218	5	<0.01	0.01	0.05	0.08
	221	5	<0.01	0.02	0.06	0.07
	224	6	<0.01	0.01	0.02	0.08
118. cadmium	209	5	<0.05	1.70	7.80	5.90
	212	5	<0.05	2.20	3.90	5.70
	215	5	<0.05	2.40	3.90	5.30
	218	5	<0.05	2.30	4.0	5.60
	221	5	<0.05	2.30	4.1	5.7
	224	6	<0.05	3.6	2.3	5.7

Table V-23 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
TREATMENT PLANT SAMPLES - PLANT A

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants						
119. chromium (total)	209	5	<0.05	2.0	6.30	3.50
	212	5	<0.05	1.50	3.20	3.20
	215	5	<0.05	1.40	2.80	3.0
	218	5	<0.05	1.40	2.80	2.80
	221	5	<0.05	1.6	2.8	2.9
	224	6	<0.05	1.8	1.4	3.5
120. copper	209	5	<0.05	200.0	520.0	230.0
	212	5	<0.05	370.0	300.0	320.0
	215	5	<0.05	390.0	320.0	310.0
	218	5	<0.05	400.0	330.0	330.0
	221	5	<0.05	430	330	340
	224	6	<0.05	210	100	190
121. cyanide (total)	209	5	0.05	<0.02	<0.02	<0.02
	212	5	0.05	<0.02	<0.02	<0.02
	215	5	0.05	<0.02	<0.02	<0.02
	218	5	0.05	<0.02	<0.02	<0.02
	221	5	0.05	<0.02	<0.02	<0.02
	224	6	0.05	<0.02	<0.02	<0.02
122. lead	209	5	<0.10	24.0	110.0	72.0
	212	5	<0.10	25.0	39.0	44.0
	215	5	<0.10	26.0	33.0	36.0
	218	5	<0.10	24.0	33.0	34.0
	221	5	<0.10	25.0	32.0	35.0
	224	6	<0.10	23.0	19.0	33.0

Table V-23 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
TREATMENT PLANT SAMPLES - PLANT A

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants						
123. mercury	209	5	0.0002	0.001	0.002	0.008
	212	5	0.0002	0.005	0.005	0.009
	215	5	0.0002	0.003	0.009	0.004
	218	5	0.0002	0.009	0.04	0.008
	221	5	0.0002	0.008	0.018	0.021
	224	6	0.0002	0.007	0.051	0.009
124. nickel	209	5	<0.20	24.0	130.0	57.0
	212	5	<0.20	34.0	58.0	68.0
	215	5	<0.20	34.0	62.0	66.0
	218	5	<0.20	34.0	64.0	68.0
	221	5	<0.20	36.0	64.0	68.0
	224	6	<0.20	48.0	36.0	90.0
125. selenium	209	5	<0.10A	<0.10A	<0.10A	<0.10A
	212	5	<0.10A	<0.10A	B	B
	215	5	<0.10A	<0.10A	B	B
	218	5	<0.10A	<0.10A	<0.10A	<0.10A
	221	5	<0.10A	<0.10A	B	B
	224	6	<0.10A	<0.10A	<0.10A	B
126. silver	209	5	<0.01	1.30	4.30	2.70
	212	5	<0.01	1.80	2.20	2.90
	215	5	<0.01	1.30	1.90	2.0
	218	5	<0.01	1.50	2.40	1.40
	221	5	<0.01	1.40	2.10	1.30
	224	6	<0.01	0.94	0.74	1.0

Table V-23 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
TREATMENT PLANT SAMPLES - PLANT A

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants						
127. thallium	209	5	<0.01	B	<0.20A	B
	212	5	<0.01	<0.50A	<0.20A	<0.20A
	215	5	<0.01	<0.20A	B	<0.50A
	218	5	<0.01	<0.02A	<0.50A	B
	221	5	<0.01	<0.50A	<0.02A	<0.5A
	224	6	<0.01	<0.5A	B	B
128. zinc	209	5	0.10	1,800	8,400	6,200
	212	5	0.10	2,600	4,100	6,200
	215	5	0.10	2,600	4,400	6,000
	218	5	0.10	2,600	4,500	6,100
	221	5	0.10	2,800	4,500	6,300
	224	6	0.10	4,100	2,600	6,100
N conventional Pollutants						
dity	209	5	<1	5,800	8,400	980
	212	5	<1	<1	170	180
	215	5	<1	<1	29	18
	218	5	<1	<1	28	29
	221	5	<1	<1	17	29
	224	6	<1	12	53	48
kalinity	209	5	98	<1	<1	<1
	212	5	98	23	<1	<1
	215	5	98	23	<1	<1
	218	5	98	26	<1	<1
	221	5	98	41	<1	<1
	224	6	98	<1	<1	<1

Table V-23 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
TREATMENT PLANT SAMPLES - PLANT A

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Nonconventional Pollutants (Continued)						
aluminum						
	209	5	0.20	15.0	230.0	112.0
	212	5	0.20	15.0	96.0	121.0
	215	5	0.20	15.0	103.0	121.0
	218	5	0.20	17.0	107.0	126.0
	221	5	0.20	16.0	105.0	128.0
	224	6	0.20	28.0	34.0	138.0
ammonia nitrogen						
	209	5	0.04	470	110	1,100
	212	5	0.04	670	670	1,100
	215	5	0.04	580	700	1,100
	218	5	0.04	590	760	910
	221	5	0.04	1,080	760	1,150
	224	6	0.04	1,700	640	770
barium						
	209	5	<0.05	1.0	<0.5	<0.5
	212	5	<0.05	<0.5	<0.5	<0.5
	215	5	<0.05	<0.5	<0.5	<0.5
	218	5	<0.05	<0.5	<0.5	<0.5
	221	5	<0.05	<0.5	<0.5	<0.5
	224	6	<0.05	<0.5	<0.5	<0.5
boron						
	209	5	<0.10	<1.0	3.0	2.0
	212	5	<0.10	<1.0	1.0	2.0
	215	5	<0.10	<1.0	2.0	2.0
	218	5	<0.10	<1.0	2.0	2.0
	221	5	<0.10	<1.0	2.0	2.0
	224	6	<0.10	<1.0	<1.0	2.0

Table V-23 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
TREATMENT PLANT SAMPLES - PLANT A

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l)			
			Source	Day 1	Day 2	Day 3
Nonconventional Pollutants (Continued)						
calcium	209	5	37.7	36.0	44.0	37.0
	212	5	37.7	36.0	38.0	38.0
	215	5	37.7	36.0	39.0	37.0
	218	5	37.7	37.0	39.0	37.0
	221	5	37.7	35.0	38.0	38.0
	224	6	37.7	36.0	37.0	40.0
chemical oxygen demand (COD)	209	5	<5	4,000	>50,000	3,100
	212	5	<5	6,100	2,400	2,400
	215	5	<5	3,900	3,700	3,400
	218	5	<5	5,000	4,900	3,600
	221	5	<5	3,200	5,500	5,200
	224	6	<5	3,600	6,200	5,100
chloride	209	5	14	12,000	13,000	17,000
	212	5	14	28,000	21,000	18,000
	215	5	14	15,000	14,000	18,000
	218	5	14	32,000	14,000	14,000
	221	5	14	15,000	15,000	18,000
	224	6	14	18,000	14,000	19,000
cobalt	209	5	<0.05	1.50	3.50	2.0
	212	5	<0.05	1.50	2.0	2.0
	215	5	<0.05	1.50	2.0	2.0
	218	5	<0.05	1.50	2.0	2.0
	221	5	<0.05	1.50	2.0	2.0
	224	6	<0.05	2.0	1.5	2.5

Table V-23 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
TREATMENT PLANT SAMPLES - PLANT A

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Nonconventional Pollutants (Continued)						
fluoride	209	5	0.28	2.4	0.13	0.73
	212	5	0.28	2.3	0.85	0.88
	215	5	0.28	0.48	0.88	0.87
	218	5	0.28	0.61	0.86	0.89
	221	5	0.28	0.32	0.87	0.92
	224	6	0.28	0.68	0.63	1.01
iron	209	5	<0.05	20.0	200.0	110.0
	212	5	<0.05	29.0	79.0	120.0
	215	5	<0.05	28.0	84.0	110.0
	218	5	<0.05	29.0	86.0	110.0
	221	5	<0.05	30.0	83.0	120.0
	224	6	<0.05	250.0	190.0	340.0
magnesium	209	5	8.5	9.0	28.0	19.0
	212	5	8.5	9.0	16.0	19.0
	215	5	8.5	9.0	17.0	19.0
	218	5	8.5	9.0	17.0	19.0
	221	5	8.5	8.0	17.0	19.0
	224	6	8.5	8.0	11.0	21.0
manganese	209	5	<0.05	0.15	0.85	0.90
	212	5	<0.05	0.30	0.75	1.20
	215	5	<0.05	0.30	0.85	1.10
	218	5	<0.05	0.25	0.85	1.20
	221	5	<0.05	0.25	0.85	1.10
	224	6	<0.05	1.30	1.20	2.60

Table V-23 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
TREATMENT PLANT SAMPLES - PLANT A

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Nonconventional Pollutants (Continued)						
molybdenum	209	5	<0.05	2.0	3.0	1.50
	212	5	<0.05	<0.50	1.0	<0.050
	215	5	<0.05	<0.50	<0.50	<0.50
	218	5	<0.05	<0.50	<0.50	<0.50
	221	5	<0.05	<0.50	<0.50	<0.50
	224	6	<0.05	<0.50	<0.50	<0.50
phosphate	209	5	14	13,000	600	310
	212	5	14	37,000	340	360
	215	5	14	3,000	360	360
	218	5	14	1,300	380	410
	221	5	14	680	380	600
	224	6	14	500	130	600
sodium	209	5	9.0	1,250	2,650	799.0
	212	5	9.0	9,540	8,150	6,910
	215	5	9.0	9,480	8,300	6,860
	218	5	9.0	10,500	8,920	7,290
	221	5	9.0	10,200	8,640	7,410
	224	6	9.0	11,600	8,780	9,390
sulfate	209	5	57	6,000	15,000	11,000
	212	5	57	9,000	11,000	15,000
	215	5	57	9,000	15,000	11,000
	218	5	57	10,000	10,000	13,000
	221	5	57	12,000	12,000	15,000
	224	6	57	9,000	11,000	18,000

Table V-23 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
TREATMENT PLANT SAMPLES - PLANT A

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
nconventional Pollutants (Continued)						
tin	209	5	<0.05	56.9	22.4	7.90
	212	5	<0.05	5.70	31.4	9.10
	215	5	<0.05	<0.5	6.4	<0.5
	218	5	<0.05	<0.5	<0.5	<0.5
	221	5	<0.05	<0.5	<5.0	<0.5
	224	6	<0.05	<5.0	<5.0	<5.0
titanium	209	5	<0.05	<0.50	24.5	11.50
	212	5	<0.05	<0.50	<0.50	1.50
	215	5	<0.05	<0.50	<0.50	<0.50
	218	5	<0.05	<0.50	<0.50	<0.50
	221	5	<0.05	<0.50	<0.50	<0.50
	224	6	<0.05	<0.50	<0.50	<0.50
total organic carbon (TOC)	209	5	4.3	100	300	330
	212	5	4.3	150	240	280
	215	5	4.3	140	240	300
	218	5	4.3	130	240	300
	221	5	4.3	150	200	270
	224	6	4.3	150	230	240

Table V-23 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
TREATMENT PLANT SAMPLES - PLANT A

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l)			
			Source	Day 1	Day 2	Day 3
Nonconventional Pollutants (Continued)						
total solids (TS)	209	5	380		40,000	30,000
	212	5	380		34,000	41,000
	215	5	380	37,000	39,000	42,000
	218	5	380	38,000	41,000	43,000
	221	5	380	42,000	41,000	44,000
	224	6	380	53,000	35,000	46,000
vanadium	209	5	<0.05	<0.50	<0.50	<0.50
	212	5	<0.05	<0.50	<0.50	<0.50
	215	5	<0.05	<0.50	<0.50	<0.50
	218	5	<0.05	<0.50	<0.50	<0.50
	221	5	<0.05	<0.50	<0.50	<0.50
	224	6	<0.05	<0.50	<0.50	<0.50
yttrium	209	5	<0.5	<0.50	<0.50	<0.50
	212	5	<0.5	<0.50	<0.50	<0.50
	215	5	<0.5	<0.50	<0.50	<0.50
	218	5	<0.5	<0.50	<0.50	<0.50
	221	5	<0.5	<0.50	<0.50	<0.50
	224	6	<0.5	<0.50	<0.50	<0.50

Table V-23 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
TREATMENT PLANT SAMPLES - PLANT A

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Conventional Pollutants						
Oil and grease	209	1	<1	3	6	5
	212	1	<1	2	6	<1
	215	1	<1	1.5	5	<1
	218	1	<1	2	2	<1
	221	1	<1	<1	<1	3
	224	1	<1	2	4	6
Total suspended solids (TSS)	209	5	60	160	140	140
	212	5	60	140	290	140
	215	5	60	88	160	180
	218	5	60	160	5,700	120
	221	5	60	360	130	110
	224	6	60	580	120	190
pH (standard units)	209	5	7.5	1.0	1.1	1.2
	212	5	7.5	4.7	4.1	3.9
	215	5	7.5	4.8	4.2	4.3
	218	5	7.5	4.81	4.21	4.1
	221	5	7.5	4.91	4.4	4.1
	224	6	7.5	4.37	4.1	3.92

†Sample Type Code: 1 - One-time grab
5 - 24-hour manual composite
6 - 24-hour automatic composite

A - Detection limit raised due to interference.

B - Chemical interference.

Table V-24

SECONDARY PRECIOUS METALS SAMPLING DATA
TREATMENT PLANT SAMPLES - PLANT B

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
ic Pollutants						
. acenaphthene	184	1	ND	ND		
acrolein	184	1	ND	ND		
. acrylonitrile	184	1	ND	ND		
. benzene	184	1	ND	ND		
. benzidine	184	1	ND	ND		
6. carbon tetrachloride	184	1	ND	ND		
7. chlorobenzene	184	1	ND	ND		
8. 1,2,4-trichlorobenzene	184	1	ND	ND		
9. hexachlorobenzene	184	1	ND	ND		
10. 1,2-dichloroethane	184	1	ND	ND		
11. 1,1,1-trichloroethane	184	1	0.01	0.01		
12. hexachloroethane	184	1	ND	ND		
13. 1,1-dichloroethane	184	1	ND	ND		
14. 1,1,2-trichloroethane	184	1	ND	ND		

Table V-24 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
TREATMENT PLANT SAMPLES - PLANT B

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
15. 1,1,2,2-tetrachloroethane	184	1	ND	ND		
16. chloroethane	184	1	ND	ND		
17. bis(chloromethyl)ether	184	1	ND	ND		
18. bis(2-chloroethyl)ether	184	1	ND	ND		
19. 2-chloroethyl vinyl ether	184	1	ND	ND		
20. 2-chloronaphthalene	184	1	ND	ND		
21. 2,4,6-trichlorophenol	184	1	ND	ND		
22. p-chloro-m-cresol	184	1	ND	ND		
23. chloroform	184	1	ND	ND		
24. 2-chlorophenol	184	1	ND	ND		
25. 1,2-dichlorobenzene	184	1	ND	ND		
26. 1,3-dichlorobenzene	184	1	ND	ND		
27. 1,4-dichlorobenzene	184	1	ND	ND		
28. 3,3'-dichlorobenzidine	184	1	ND	ND		

Table V-24 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
TREATMENT PLANT SAMPLES - PLANT B

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
29. 1,1-dichloroethylene	184	1	ND	ND		
30. 1,2-*trans*-dichloroethylene	184	1	ND	ND		
31. 2,4-dichlorophenol	184	1	ND	ND		
32. 1,2-dichloropropane	184	1	ND	ND		
33. 1,3-dichloropropene	184	1	ND	ND		
34. 2,4-dimethylphenol	184	1	ND	ND		
35. 2,4-dinitrotoluene	184	1	ND	ND		
6. 2,6-dinitrotoluene	184	1	ND	ND		
7. 1,2-diphenylhydrazine	184	1	ND	ND		
8. ethylbenzene	184	1	ND	ND		
. fluoranthene	184	1	ND	ND		
. 4-chlorophenyl phenyl ether	184	1	ND	ND		
41. 4-bromophenyl phenyl ether	184	1	ND	ND		
42. bis(2-chloroisopropyl)ether	184	1	ND	ND		

Table V-24 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
TREATMENT PLANT SAMPLES - PLANT B

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
43. bis(2-choroethoxy)methane	184	1	ND	ND		
44. methylene chloride	184	1	ND	ND		
45. methyl chloride (chloromethane)	184	1	ND	ND		
6. methyl bromide (bromomethane)	184	1	ND	ND		
. bromoform (tribromomethane)	184	1	ND	ND		
8. dichlorobromomethane	184	1	ND	ND		
9. trichlorofluoromethane	184	1	ND	ND		
0. dichlorodifluoromethane	184	1	ND	ND		
51. chlorodibromomethane	184	1	ND	ND		
52. hexachlorobutadiene	184	1	ND	ND		
53. hexachlorocyclopentadiene	184	1	ND	ND		
54. isophorone	184	1	ND	ND		
55. naphthalene	184	1	ND	ND		
56. nitrobenzene	184	1	ND	ND		

Table V-24 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA TREATMENT PLANT SAMPLES - PLANT B

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
57. 2-nitrophenol	184	1	ND	ND		
58. 4-nitrophenol	184	1	ND	ND		
59. 2,4-dinitrophenol	184	1	ND	ND		
60. 4,6-dinitro-o-cresol	184	1	ND	ND		
61. N-nitrosodimethylamine	184	1	ND	ND		
62. N-nitrosodiphenylamine	184	1	ND	ND		
63. N-nitrosodi-n-propylamine	184	1	ND	ND		
64. pentachlorophenol	184	1	ND	ND		
65. phenol	184	1	ND	0.028		
66. bis(2-ethylhexyl) phthalate	184	1	0.026	0.030		
67. butyl benzyl phthalate	184	1	ND	ND		
68. di-n-butyl phthalate	184	1	ND	0.002		
69. di-n-octyl phthalate	184	1	ND	0.001		
70. diethyl phthalate	184	1	ND	ND		

Table V-24 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
TREATMENT PLANT SAMPLES - PLANT B

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
71. dimethyl phthalate	184	1	ND	0.02		
72. benzo(a)anthracene	184	1	ND	ND		
73. benzo(a)pyrene	184	1	ND	ND		
74. benzo(b)fluoranthene	184	1	ND	ND		
75. benzo(k)fluoranthane	184	1	ND	ND		
76. chrysene	184	1	ND	ND		
77. acenaphthylene	184	1	ND	ND		
78. anthracene (a)	184	1	ND	ND		
79. benzo(ghi)perylene	184	1	ND	ND		
80. fluorene	184	1	ND	ND		
[illegible]. phenanthrene (a)	184	1	ND	ND		
[illegible]. dibenzo(a,h)anthracene	184	1	ND	ND		
[illegible]. indeno (1,2,3-c,d)pyrene	184	1	ND	ND		
8[illegible]. pyrene	184	1	ND	ND		

Table V-24 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
TREATMENT PLANT SAMPLES - PLANT B

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
85. tetrachloroethylene	184	1	ND	ND		
86 toluene	184	1	ND	ND		
87 trichloroethylene	184	1	ND	ND		
88. vinyl chloride (chloroethylene)	184	1	ND	ND		
114. antimony	184	1	<0.003	2.6		
	011	1	<0.003	0.20	0.21	1.8
	012	1	<0.003	0.35	0.097	0.29
115. arsenic	184	1	<0.003	0.84		
	011	1	<0.003	0.12	0.073	0.43
	012	1	<0.003	0.061	0.023	0.043
117. beryllium	184	1	<0.01	<0.01		
	011	1	<0.01	<0.01	<0.01	<0.01
	012	1	<0.01	<0.01	<0.01	<0.01
118. cadmium	184	1	<0.01	<0.01		
	011	1	<0.01	1.0	0.53	0.81
	012	1	<0.01	<0.01	<0.01	<0.01
119. chromium (total)	184	1	<0.01	0.42		
	011	1	<0.01	0.22	0.04	0.21
	012	1	<0.01	0.11	<0.01	<0.01

Table V-24 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
TREATMENT PLANT SAMPLES - PLANT B

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
120. copper	184	1	<0.01	0.40		
	011	1	<0.01	2.0	1.8	23
	012	1	<0.01	1.1	0.12	<0.01
121. cyanide (total)	184	1	<0.02	<0.02		
	011	1	<0.02	<0.02	<0.02	<0.02
	012	1	<0.02	<0.02	<0.02	<0.02
122. lead	184	1	<0.01	3.2		
	011	1	<0.01	0.59	1.5	2.0
	012	1	<0.01	0.28	<0.10	<0.10
123. mercury	184	1	0.002	0.38		
	011	1	0.002	0.14	0.005	0.175
	012	1	0.002	0.002	<0.0002	<0.0002
124. nickel	184	1	0.075	101		
	011	1	0.075	90	30	60
	012	1	0.075	0.60	0.61	1.7
125. selenium	184	1	<0.003	0.18		
	011	1	<0.003	0.010	0.013	0.082
	012	1	<0.003	0.014	0.010	0.012
126. silver	184	1	<0.0005	0.041		
	011	1	<0.0005	0.081	0.069	0.056
	012	1	<0.0005	0.035	0.049	0.077

Table V-24 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
TREATMENT PLANT SAMPLES - PLANT B

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
127. thallium	184	1	<0.002	<0.002		
	011	1	<0.002	<0.002	<0.002	<0.002
	012	1	<0.002	<0.002	<0.002	<0.002
128. zinc	184	1	2.5	1,900		
	011	1	2.5	2,800	0.30	1,300
	012	1	2.5	56	6.9	41
Nonconventional Pollutants						
acidity	184	1	<1	<1		
	011	1	<1	<1	<1	<1
	012	1	<1	<1	<1	<1
alkalinity	184	1	127	>8,000		
	011	1	127	>8,000	1,090	8,400
	012	1	127	1,200	1,000	1,460
aluminum	184	1	<0.05	7.7		
	011	1	<0.05	49	24	11
	012	1	<0.05	2.8	1.8	<0.05
ammonia nitrogen	184	1	<0.01	2,300		
	011	1	<0.01	2,300	220	<0.01
	012	1	<0.01	670	1,070	<0.01

Table V-24 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
TREATMENT PLANT SAMPLES - PLANT B

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Noncoventional Pollutants (Continued)						
barium	184	1	0.07	0.66		
	011	1	0.07	1.2	1.1	0.71
	012	1	0.07	0.24	0.85	0.05
boron	184	1	<0.009	3.8		
	011	1	<0.009	2.9	2.7	3.4
	012	1	<0.009	3.4	2.2	3.3
calcium	184	1	11	430		
	011	1	11	9,600	6,000	1,100
	012	1	11	730	5,200	19
chemical oxygen demand (COD)	011	1				990
	012	1				640
chloride	184	1	52	40,000		
	011	1	52	45,000	33,000	1,000
	012	1	52	21,000	200	1,200
cobalt	184	1	<0.006	4.6		
	011	1	<0.006	5.7	2.7	2.9
	012	1	<0.006	0.70	0.17	0.18
fluoride	184	1	1.1	11.0		
	011	1	1.1	0.81	1.9	1.5
	012	1	1.1	7.9	2.0	7.9

Table V-24 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
TREATMENT PLANT SAMPLES - PLANT B

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
coventional Pollutants (Continued)						
n	184	1	0.31	310		
	011	1	0.31	460	200	200
	012	1	0.31	1.1	0.15	0.21
nesium	184	1	2.4	15.0		
	011	1	2.4	21.0	12.0	11.0
	012	1	2.4	1.0	1.3	2.2
manganese	184	1	<0.01	3.0		
	011	1	<0.01	5.0	2.4	2.2
	012	1	<0.01	<0.01	<0.01	<0.01
molybdenum	184	1	<0.002	0.23		
	011	1	<0.002	0.15	0.075	0.13
	012	1	<0.002	0.039	0.019	0.066
phosphate	011	1				<4
	012	1				<4
sodium	184	1	54	26,000		
	011	1	54	16,000	13,000	22,000
	012	1	54	14,000	11,000	23,000
sulfate	184	1	13	3,400		
	011	1	13	<0.6	930	2,500
	012	1	13	2,100	830	1,500

Table V-24 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
TREATMENT PLANT SAMPLES - PLANT B

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Nonconventional Pollutants (Continued)						
tin	184	1	<0.12	<0.12		
	011	1	<0.12	<0.12	1.3	<0.12
	012	1	<0.12	<0.12	6.9	<0.12
titanium	184	1	<0.005	0.26		
	011	1	<0.005	2.1	1.0	0.19
	012	1	<0.005	0.056	0.11	<0.005
total organic carbon (TOC)	184	1	43	38		
	011	1	43	97	110	260
	012	1	43	94	140	130
total solids (TS)	184	1	410	87,000		
	011	1	410	93,000	61,000	72,000
	012	1	410	42,000	52,000	43,000
vanadium	184	1	<0.003	0.072		
	011	1	<0.003	0.17	0.078	<0.003
	012	1	<0.003	0.063	0.09	<0.003
yttrium	184	1	<0.002	0.015		
	011	1	<0.002	0.014	0.064	0.006
	012	1	<0.002	0.014	0.046	<0.002

Table V-24 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
TREATMENT PLANT SAMPLES - PLANT B

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l)			
			Source	Day 1	Day 2	Day 3
Conventional Pollutants						
oil and grease	184	1	<1	<1		
	011	1	<1	6	<1	<1
	012	1	<1	<1	<1	<1
total suspended solids (TSS)	184	1	8	5,700		
	011	1	8	2,300	3,900	4,500
	012	1	8	2,500	5,700	53
pH (standard units)	184	1	7.36	8.61		
	011	1	7.36	10.09	10.00	8.76
	012	1	7.36	9.94	10.07	8.65

†Sample Type Code: 1 - One-time grab

(a) Reported together.

Table V-25

SECONDARY PRECIOUS METALS SAMPLING DATA
TREATMENT PLANT SAMPLES - PLANT C

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants						
1. acenaphthene	7	3	ND	ND	ND	ND
	2	6	ND	ND	ND	ND
2. acrolein	7	1	ND	ND	ND	ND
	2	1	ND	ND	ND	ND
3. acrylonitrile	7	1	ND	ND	ND	ND
	2	1	ND	ND	ND	ND
4. benzene	7	1	ND	ND	ND	ND
	2	1	ND	ND	ND	ND
5. benzidine	7	3	ND	ND	ND	ND
	2	6	ND	ND	ND	ND
6. carbon tetrachloride	7	1	ND	ND	ND	ND
	2	1	ND	ND	ND	ND
7. chlorobenzene	7	1	ND	ND	ND	ND
	2	1	ND	ND	ND	ND
8. 1,2,4-trichlorobenzene	7	3	ND	ND	ND	ND
	2	6	ND	ND	ND	ND
9. hexachlorobenzene	7	3	ND	ND	ND	ND
	2	6	ND	ND	ND	ND

Table V-25 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
TREATMENT PLANT SAMPLES - PLANT C

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l)			
			Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
10. 1,2-dichloroethane	7	1	ND	ND	<0.01	ND
	2	1	ND	ND	ND	ND
11. 1,1,1-trichloroethane	7	1	ND	ND	ND	ND
	2	1	ND	ND	ND	ND
12. hexachloroethane	7	3	ND	ND	ND	ND
	2	6	ND	ND	ND	ND
13. 1,1-dichloroethane	7	1	ND	ND	ND	ND
	2	1	ND	ND	ND	ND
14. 1,1,2-trichloroethane	7	1	ND	ND	ND	ND
	2	1	ND	ND	ND	ND
15. 1,1,2,2-tetrachloroethane	7	1	ND	ND	ND	ND
	2	1	ND	ND	ND	ND
16. chloroethane	7	1	ND	ND	ND	ND
	2	1	ND	ND	ND	ND
17. bis(chloromethyl)ether	7	1	ND	ND	ND	ND
	2	1	ND	ND	ND	ND
18. bis(2-chloroethyl)ether	7	3	ND	ND	ND	ND
	2	6	ND	ND	ND	ND

Table V-25 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
TREATMENT PLANT SAMPLES - PLANT C

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
19. 2-chloroethyl vinyl ether	7	1	ND	ND	ND	ND
	2	1	ND	ND	ND	ND
20. 2-chloronaphthalene	7	3	ND	ND	ND	ND
	2	6	ND	ND	ND	ND
21. 2,4,6-trichlorophenol	7	3	ND	ND	<0.01	ND
	2	6	ND	ND	ND	ND
22. p-chloro-m-cresol	7	3	ND	ND	ND	ND
	2	6	ND	ND	ND	ND
23. chloroform	7	1	0.05	0.06	0.02	0.02
	2	1	0.05	0.13	0.02	0.02
24. 2-chlorophenol	7	3	ND	ND	ND	ND
	2	6	ND	ND	ND	ND
25. 1,2-dichlorobenzene	7	3	ND	ND	ND	ND
	2	6	ND	ND	ND	ND
26. 1,3-dichlorobenzene	7	3	ND	ND	ND	ND
	2	6	ND	ND	ND	ND
27. 1,4-dichlorobenzene	7	3	ND	ND	ND	ND
	2	6	ND	ND	ND	ND

Table V-25 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
TREATMENT PLANT SAMPLES - PLANT C

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
28. 3,3'-dichlorobenzidine	7	3	ND	ND	ND	ND
	2	6	ND	ND	ND	ND
29. 1,1-dichloroethylene	7	1	ND	ND	ND	ND
	2	1	ND	ND	ND	ND
30. 1,2-trans-dichloroethylene	7	1	ND	ND	ND	ND
	2	1	ND	ND	ND	ND
31. 2,4-dichlorophenol	7	3	ND	ND	<0.01	ND
	2	6	ND	ND	ND	ND
32. 1,2-dichloropropane	7	1	ND	ND	ND	ND
	2	1	ND	ND	ND	ND
. 1,3-dichloropropene	7	1	ND	ND	ND	ND
	2	1	ND	ND	ND	ND
34. 2,4-dimethylphenol	7	3	ND	ND	ND	ND
	2	6	ND	ND	ND	ND
35. 2,4-dinitrotoluene	7	3	ND	ND	ND	ND
	2	6	ND	ND	ND	ND
36. 2,6-dinitrotoluene	7	3	ND	ND	ND	ND
	2	6	ND	ND	ND	ND

Table V-25 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
TREATMENT PLANT SAMPLES - PLANT C

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
37. 1,2-diphenylhydrazine	7	3	ND	ND	ND	ND
	2	6	ND	ND	ND	ND
38. ethylbenzene	7	1	ND	ND	ND	ND
	2	1	ND	ND	ND	ND
39. fluoranthene	7	3	ND	ND	ND	ND
	2	6	ND	ND	ND	ND
40. 4-chlorophenyl phenyl ether	7	3	ND	ND	ND	ND
	2	6	ND	ND	ND	ND
41. 4-bromophenyl phenyl ether	7	3	ND	ND	ND	ND
	2	6	ND	ND	ND	ND
42. bis(2-chloroisopropyl)ether	7	3	ND	ND	ND	ND
	2	6	ND	ND	ND	ND
43. bis(2-choroethoxy)methane	7	3	ND	ND	ND	ND
	2	6	ND	ND	ND	ND
44. methylene chloride	7	1	<0.01	<0.01	<0.01	<0.01
	2	1	<0.01	<0.01	<0.01	<0.01
45. methyl chloride (chloromethane)	7	1	ND	ND	ND	ND
	2	1	ND	ND	ND	ND

Table V-25 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
TREATMENT PLANT SAMPLES - PLANT C

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
46. methyl bromide (bromomethane)	7	1	ND	ND	ND	ND
	2	1	ND	ND	ND	ND
47. bromoform (tribromomethane)	7	1	ND	ND	ND	ND
	2	1	ND	<0.01	ND	ND
48. dichlorobromomethane	7	1	<0.01	<0.01	<0.01	<0.01
	2	1	<0.01	<0.01	<0.01	<0.01
49. trichlorofluoromethane	7	1	ND	<0.01	ND	ND
	2	1	ND	ND	ND	ND
50. dichlorodifluoromethane	7	1	ND	ND	ND	ND
	2	1	ND	ND	ND	ND
51. chlorodibromomethane	7	1	<0.01	<0.01	ND	ND
	2	1	<0.01	0.02	ND	ND
52. hexachlorobutadiene	7	3	ND	ND	ND	ND
	2	6	ND	ND	ND	ND
53. hexachlorocyclopentadiene	7	3	ND	ND	ND	ND
	2	6	ND	ND	ND	ND
54. isophorone	7	3	ND	ND	ND	ND
	2	6	ND	ND	<0.01	ND

Table V-25 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
TREATMENT PLANT SAMPLES - PLANT C

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
55. naphthalene	7	3	ND	ND	ND	ND
	2	6	ND	ND	ND	ND
56. nitrobenzene	7	3	ND	ND	ND	ND
	2	6	ND	ND	ND	ND
57. 2-nitrophenol	7	3	ND	<0.01	<0.01	ND
	2	6	ND	<0.01	<0.01	ND
58 4-nitrophenol	7	3	ND	<0.01	0.019	ND
	2	6	ND	ND	<0.01	ND
59. 2,4-dinitrophenol	7	3	ND	ND	ND	ND
	2	6	ND	ND	0.110	ND
60. 4,6-dinitro-o-cresol	7	3	ND	ND	ND	ND
	2	6	ND	ND	ND	ND
61. N-nitrosodimethylamine	7	3	ND	ND	ND	ND
	2	6	ND	ND	ND	ND
62. N-nitrosodiphenylamine	7	3	ND	ND	ND	ND
	2	6	ND	ND	ND	ND
63. N-nitrosodi-n-propylamine	7	3	ND	ND	ND	ND
	2	6	ND	ND	ND	ND

Table V-25 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
TREATMENT PLANT SAMPLES - PLANT C

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
64. pentachlorophenol	7	3	ND	ND	<0.01	ND
	2	6	ND	ND	ND	ND
65. phenol	7	3	ND	<0.01	0.018	<0.01
	2	6	ND	0.03	0.01	0.01
66. bis(2-ethylhexyl) phthalate	7	3	0.02	0.01	<0.01	0.01
	2	6	0.02	<0.01	<0.01	<0.01
67. butyl benzyl phthalate	7	3	ND	ND	ND	ND
	2	6	ND	ND	ND	ND
68 di-n-butyl phthalate	7	3	<0.01	<0.01	<0.01	<0.01
	2	6	<0.01	<0.01	<0.01	<0.01
69. di-n-octyl phthalate	7	3	ND	ND	ND	ND
	2	6	ND	ND	ND	ND
70. diethyl phthalate	7	3	<0.01	<0.01	<0.01	<0.01
	2	6	<0.01	<0.01	<0.01	<0.01
71. dimethyl phthalate	7	3	ND	ND	ND	ND
	2	6	ND	ND	ND	ND
72. benzo(a)anthracene	7	3	ND	ND	ND	ND
	2	6	ND	ND	ND	ND

Table V-25 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
TREATMENT PLANT SAMPLES - PLANT C

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
73. benzo(a)pyrene	7	3	ND	ND	ND	ND
	2	6	ND	ND	ND	ND
74. benzo(b)fluoranthene	7	3	ND	ND	ND	ND
	2	6	ND	ND	ND	ND
75. benzo(k)fluoranthane	7	3	ND	ND	ND	ND
	2	6	ND	ND	ND	ND
76. chrysene	7	3	ND	ND	ND	ND
	2	6	ND	ND	ND	ND
77. acenaphthylene	7	3	ND	ND	ND	ND
	2	6	ND	ND	ND	ND
78. anthracene (a)	7	3	ND	ND	ND	ND
	2	6	ND	ND	ND	ND
79. benzo(ghi)perylene	7	3	ND	ND	ND	ND
	2	6	ND	ND	ND	ND
80. fluorene	7	3	ND	ND	ND	ND
	2	6	ND	ND	ND	ND
81. phenanthrene (a)	7	3	ND	ND	ND	ND
	2	6	ND	ND	ND	ND

Table V-25 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
TREATMENT PLANT SAMPLES - PLANT C

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
82. dibenzo(a,h)anthracene	7	3	ND	ND	ND	ND
	2	6	ND	ND	ND	ND
83. indeno (1,2,3-c,d)pyrene	7	3	ND	ND	ND	ND
	2	6	ND	ND	ND	ND
84. pyrene	7	3	ND	ND	ND	ND
	2	6	ND	ND	ND	ND
85. tetrachloroethylene	7	1	ND	ND	ND	ND
	2	1	ND	ND	ND	ND
86. toluene	7	1	ND	ND	ND	ND
	2	1	ND	<0.01	<0.01	<0.01
87. trichloroethylene	7	1	ND	<0.01	ND	<0.01
	2	1	ND	ND	ND	ND
88. vinyl chloride (chloroethylene)	7	1	ND	ND	ND	<0.01
	2	1	ND	ND	ND	ND
114. antimony	7	3	<0.003	0.15	0.03	0.022
	2	6	<0.003	0.016	0.021	0.014
115 arsenic	7	3	<0.005	0.013	0.004	0.005
	2	6	<0.005	0.016	0.013	0.005

Table V-25 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
TREATMENT PLANT SAMPLES - PLANT C

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
117. beryllium	7	3	<0.0002	0.006	0.013	0.003
	2	6	<0.0002	0.003	0.007	0.003
118. cadmium	7	3	0.0002	0.11	0.10	0.04
	2	6	0.0002	0.04	0.09	0.06
. chromium (total)	7	3	0.003	0.76	0.45	0.16
	2	6	0.003	0.35	0.71	0.17
120. copper	7	3	0.017	2.10	0.57	0.73
	2	6	0.017	1.80	2.90	2.10
121. cyanide (total)	7	1	0.053	9.0	70.0	190.0
	2	1	0.053	8.0	16.0	140.0
122. lead	7	3	0.03	0.63	0.51	0.75
	2	6	0.03	0.19	0.41	0.31
123. mercury	7	3	0.0002	0.0002	<0.0001	<0.0001
	2	6	0.0002	0.0003	<0.0001	<0.0001
124. nickel	7	3	0.02	3.70	7.20	0.720
	2	6	0.02	0.39	4.20	2.80
125. selenium	7	3	<0.002	740.0	<0.002	<0.002
	2	6	<0.002	<0.002	<0.002	<0.002

Table V-25 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
TREATMENT PLANT SAMPLES - PLANT C

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
ic Pollutants (Continued)						
. silver	7	3	<0.0002	0.05	0.06	0.03
	2	6	<0.0002	0.049	0.05	0.10
. thallium	7	3	<0.001	<0.004	<0.004	0.012
	2	6	<0.001	<0.003	<0.004	0.30
28. zinc	7	3	<0.01	180.0	170.0	140.0
	2	6	<0.01	91.0	160.0	150.0
Nonconventional Pollutants						
alkalinity	7	3	16	1,900	0	870
	2	6	16	23	300	18
calcium	7	3	13	8.2	9.6	7.3
	2	6	13	10.0	9.0	9.5
iron	7	3	0.29	2.3	48	4.5
	2	6	0.29	3.4	14	3.6
magnesium	7	3	3.1	3.3	3.4	2.6
	2	6	3.1	3.5	3.7	2.9
phenolics	7	1	0.15	0.110	0.017	0.008
	2	1	0.15	0.088	0.063	0.054

Table V-25 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
TREATMENT PLANT SAMPLES - PLANT C

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Conventional Pollutants						
oil and grease	7	1	1.6	2.4	<1.7	<1.0
	2	1	1.6	<1	<1	<1
total suspended solids (TSS)	7	3	0	140	6	24
	2	6	0	0	59	3
pH (standard units)	7	3	6.8	1.9	2.0	8.9
	2	6	6.8	10.0	10.5	6.7

†Sample Type Code:
1 - One-time grab
3 - 8-hour manual composite
6 - 24-hour automatic composite

(a) Reported together.

Table V-26

SECONDARY PRECIOUS METALS SAMPLING DATA
CASTING CONTACT COOLING WATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants						
114. antimony	204	1	<0.01	<0.01		
115. arsenic	204	1	<0.01	<0.01		
117. beryllium	204	1	<0.01	<0.01		
118. cadmium	204	1	<0.05	<0.05		
119. chromium (total)	204	1	<0.05	<0.05		
120. copper	204	1	<0.05	0.05		
121. cyanide (total)	204	1	0.05	0.36		
122. lead	204	1	<0.10	<0.10		
123. mercury	204	1	0.0002	0.0004		
124. nickel	204	1	<0.2	0.20		
125. selenium	204	1	<0.1A	<0.1A		
126. silver	204	1	<0.01	<0.01		
127. thallium	204	1	<0.01	<0.01		
128. zinc	204	1	0.10	0.15		

Table V-26 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
CASTING CONTACT COOLING WATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Nonconventional Pollutants						
acidity	204	1	<1	<1		
alkalinity	204	1	98	120		
aluminum	204	1	0.2	0.2		
ammonia nitrogen	204	1	0.04	0.06		
barium	204	1	<0.05	<0.05		
boron	204	1	<0.1	1.8		
calcium	204	1	37.7	37.3		
chemical oxygen demand (COD)	204	1	<5	33		
chloride	204	1	14	250		
cobalt	204	1	<0.05	<0.05		
fluoride	204	1	0.28	0.31		
iron	204	1	<0.05	1.5		
magnesium	204	1	8.5	8.3		

Table V-26 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
CASTING CONTACT COOLING WATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Nonconventional Pollutants (Continued)						
manganese	204	1			<0.05	
molybdenum	204	1			<0.05	
phosphate	204	1			36	
sodium	204	1			22	
sulfate	204	1			79	
tin	204	1			<0.05	
titanium	204	1			<0.05	
total organic carbon (TOC)	204	1			24	
total solids (TS)	204	1			410	
vanadium	204	1			<0.05	
yttrium	204	1			<0.05	

Table V-26 (Continued)

SECONDARY PRECIOUS METALS SAMPLING DATA
CASTING CONTACT COOLING WATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Conventional Pollutants						
oil and grease	204	1	17		20	
total suspended solids (TSS)	204	1	60		44	
pH (standard units)	204	1	7.5		7.3	

†Sample Type Code: 1 - One-time grab

A - Detection limit raised due to interference.

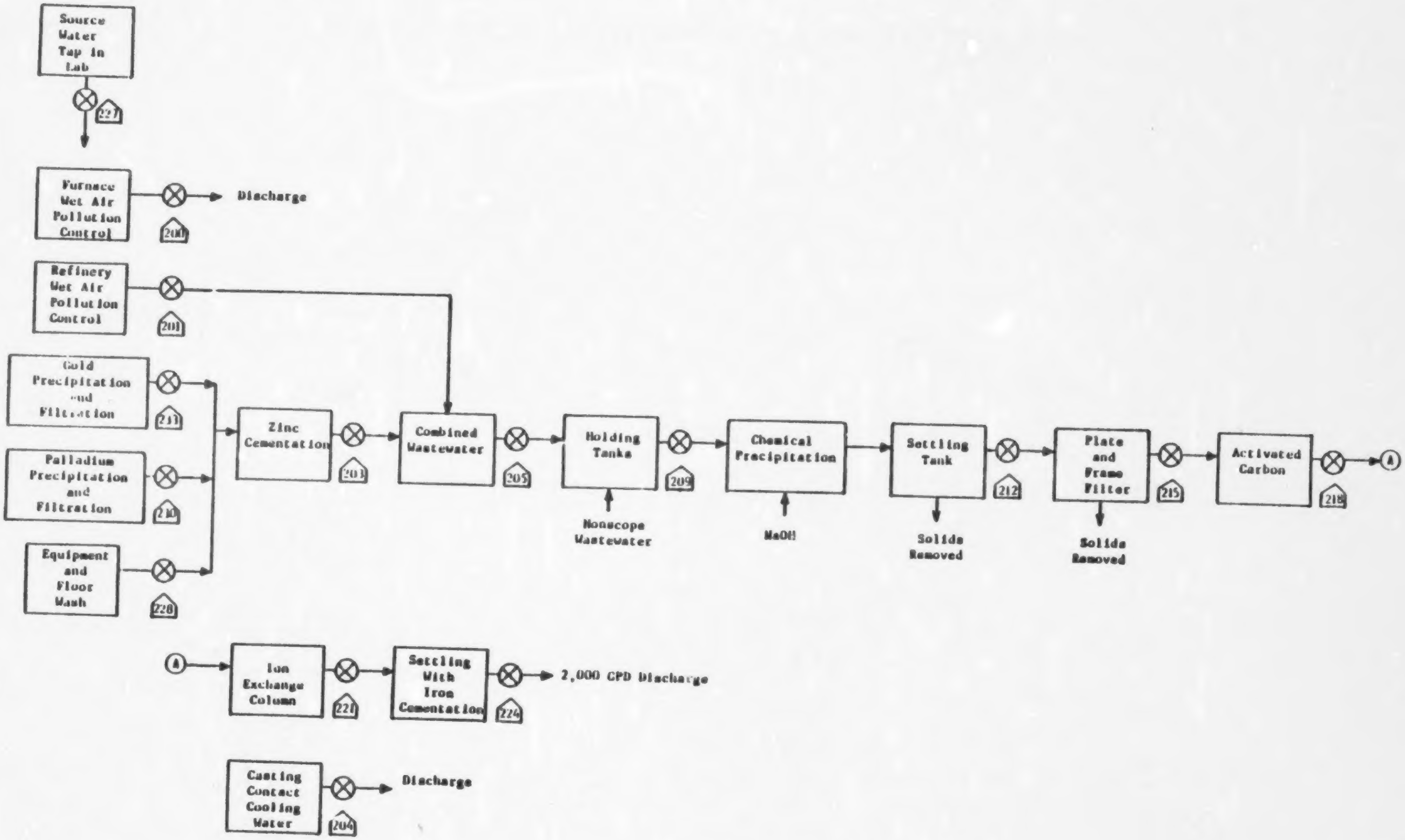
Source Water Tap in Lab
227
Furnace Wet Air Pollution Control
200
Discharge
Refinery Wet Air Pollution Control
201
Gold Precipitation and Filtration
211
Palladium Precipitation and Filtration
210
Equipment and Floor Wash
228
Zinc Cementation
203
Combined Wastewater
205
Holding Tanks
Nonscope Wastewater
209
Chemical Precipitation
NaOH
Settling Tank
Solids Removed
212
Plate and Frame Filter
Solids Removed
215
Activated Carbon
218
A
A
Ion Exchange Column
221
Settling With Iron Cementation
224
2,000 GPD Discharge
Casting Contact Cooling Water
204
Discharge

Figure V-1
SAMPLING SITES AT SECONDARY PRECIOUS METALS PLANT A

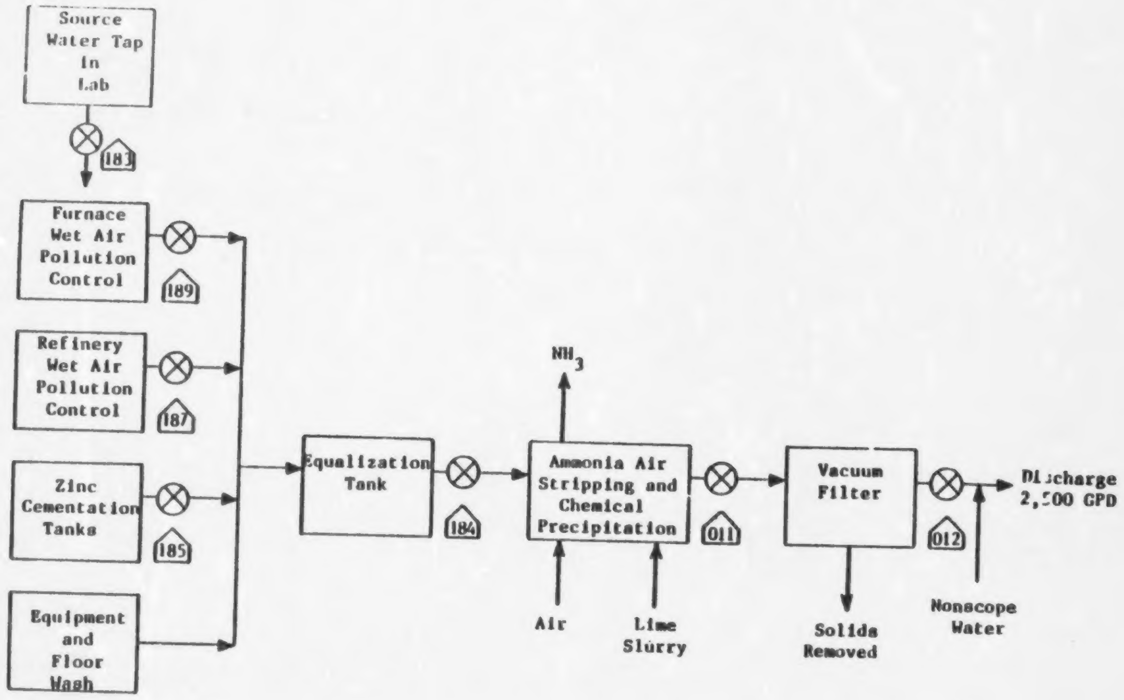
Source Water Tap In Lab
183
Furnace Wet Air Pollution Control
189
Refinery Wet Air Pollution Control
187
Zinc Cementation Tanks
185
Equipment and Floor Wash
Equalization Tank
184
NH$_3$
Ammonia Air Stripping and Chemical Precipitation
Air
Lime Slurry
011
Vacuum Filter
Solids Removed
012
Nonscope Water
Discharge 2,500 GPD

Figure V-2

SAMPLING SITES AT SECONDARY PRECIOUS METALS PLANT B

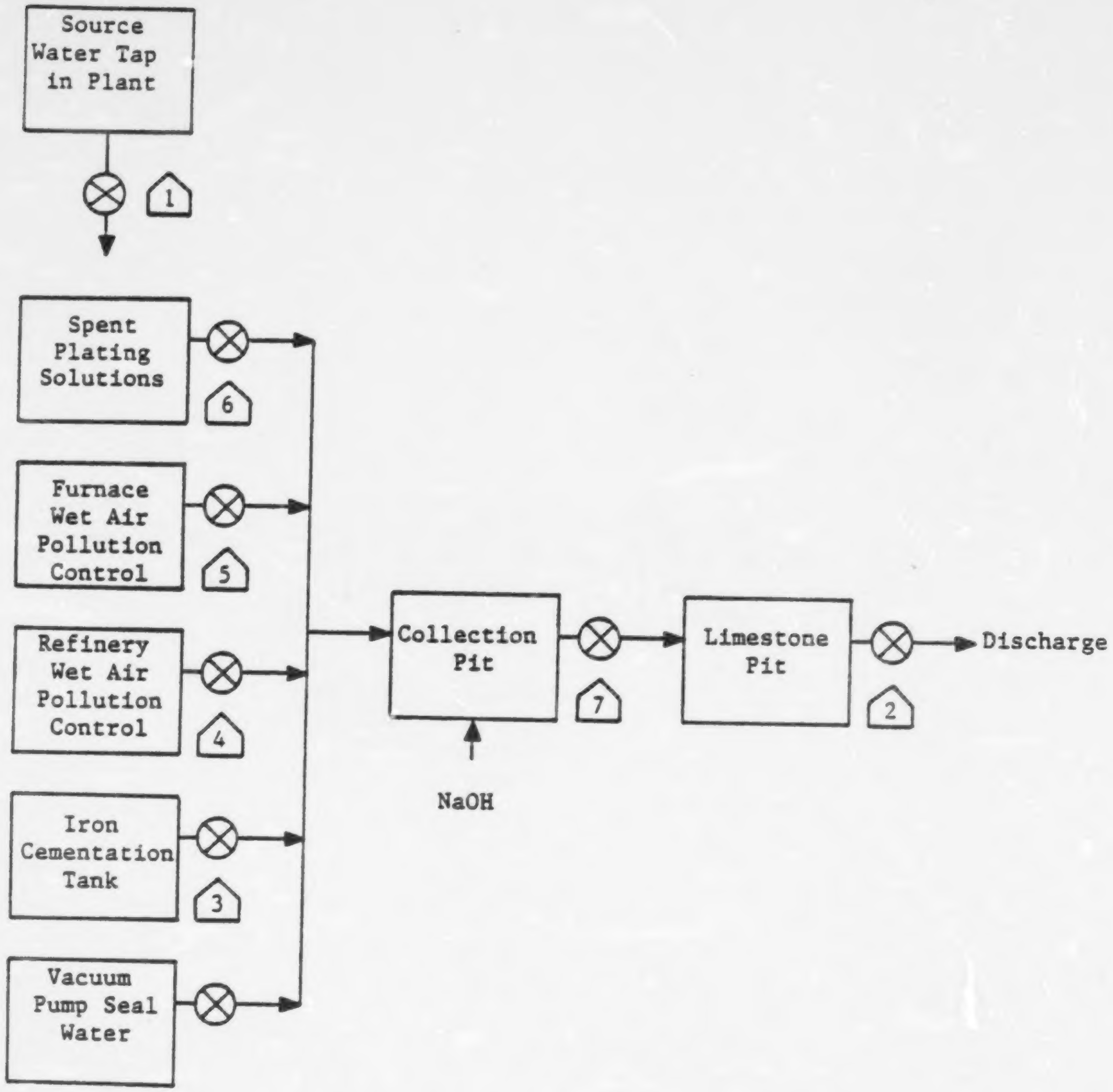
Source Water Tap in Plant
1
Spent Plating Solutions
6
Furnace Wet Air Pollution Control
5
Refinery Wet Air Pollution Control
4
Iron Cementation Tank
3
Vacuum Pump Seal Water
Collection Pit
7
NaOH
Limestone Pit
2
Discharge

Figure V-3

SAMPLING SITES AT SECONDARY PRECIOUS METALS PLANT C

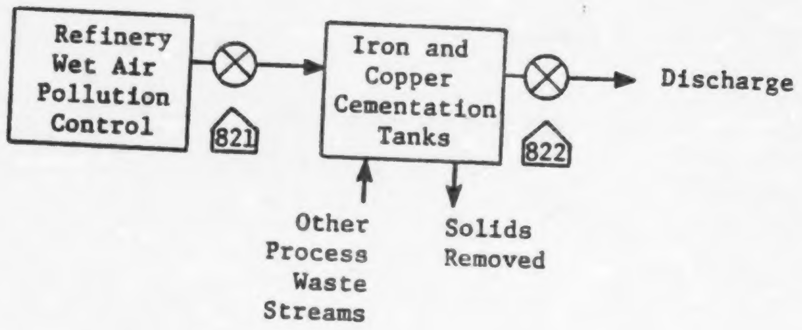
Refinery Wet Air Pollution Control
821
Iron and Copper Cementation Tanks
822
Discharge
Other Process Waste Streams
Solids Removed

Figure V-4

SAMPLING SITES AT SECONDARY PRECIOUS METALS PLANT D

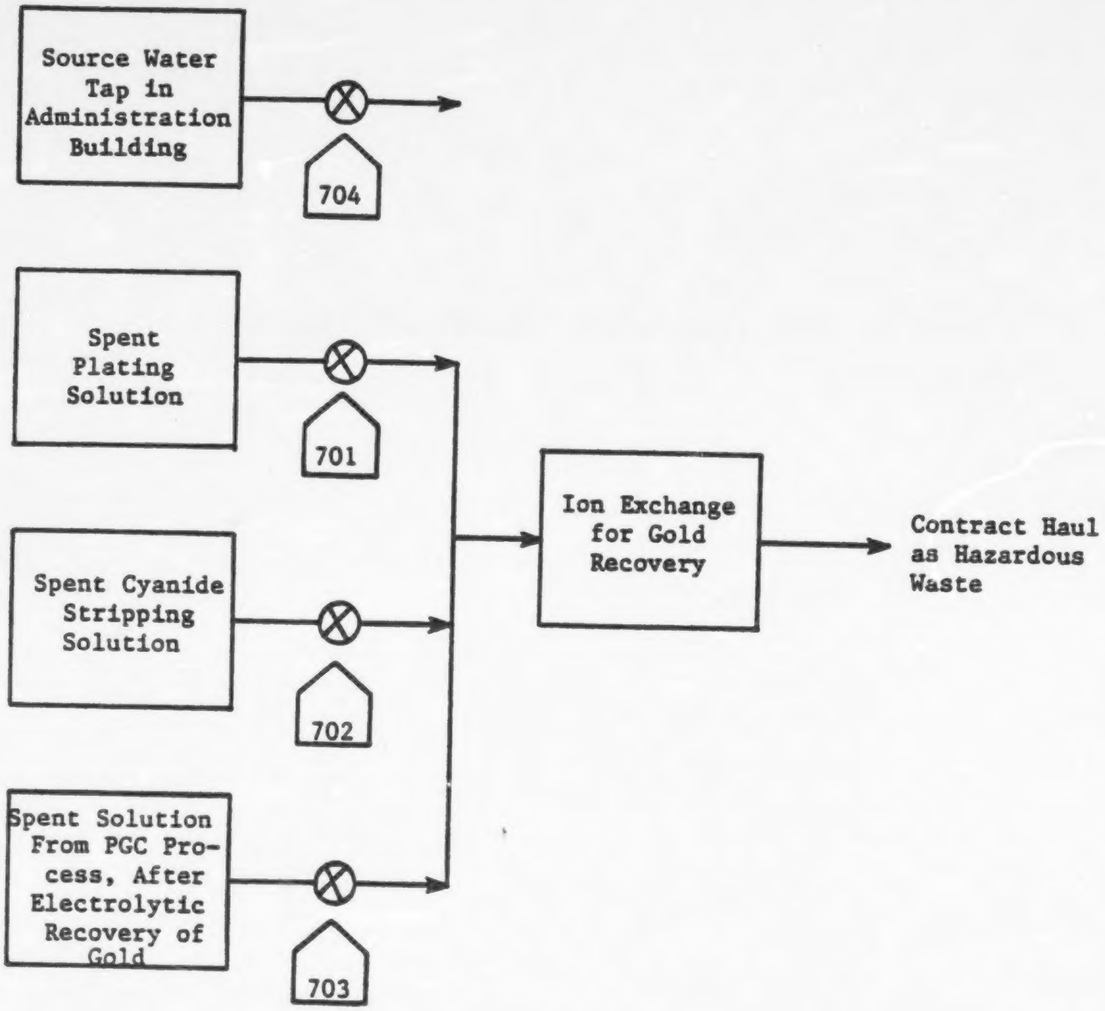
Source Water Tap in Administration Building
704
Spent Plating Solution
701
Spent Cyanide Stripping Solution
702
Spent Solution From PGC Process, After Electrolytic Recovery of Gold
703
Ion Exchange for Gold Recovery
Contract Haul as Hazardous Waste

Figure V-5
SAMPLING SITES AT SECONDARY PRECIOUS METALS PLANT E

SECTION VI

SELECTION OF POLLUTANT PARAMETERS

This section examines the chemical analysis data presented in Section V and discusses the selection or exclusion of pollutants for potential limitation. The basis for the regulation of toxic and other pollutants along with a discussion of each pollutant selected for potential limitation is discussed in Section VI of Vol. I. That discussion provides information concerning where the pollutant originates (i.e., whether it is a naturally occurring substance, processed metal, or a manufactured compound); general physical properties and the form of the pollutant toxic effects of the pollutant in humans and other animals; and behavior of the pollutant in POTW at the concentrations expected in industrial discharges.

The discussion that follows describes the analysis that was performed to select or exclude toxic pollutants for further consideration for limitations and standards. Pollutants will be considered for limitation if they are present in concentrations treatable by the technologies considered in this analysis. Also described is the analysis performed to select or exclude conventional and nonconventional pollutants for limitation. The treatment effectiveness concentrations used for the toxic metals were the long-term performance values achievable by chemical precipitation, sedimentation, and filtration (lime, settle and filter). The achievable concentrations used for the toxic organics were the long-term values achievable by carbon adsorption (see Section VII of Vol. I -- Combined Metals Data Base).

CONVENTIONAL AND NONCONVENTIONAL POLLUTANT PARAMETERS

This study examined samples from the secondary precious metals subcategory for three conventional pollutant parameters (oil and grease, total suspended solids, and pH) and two nonconventional pollutant parameters (ammonia, and combined metals (gold, platinum, and palladium)).

CONVENTIONAL AND NONCONVENTIONAL POLLUTANT PARAMETERS SELECTED

The conventional and nonconventional pollutants and pollutant parameters selected for limitation in this subcategory are:

ammonia
combined metals (the sum of gold, platinum, and palladium)
total suspended solids (TSS)
pH

Ammonia was found in 10 of 12 samples analyzed in concentrations ranging from 0.24 to 5,060 mg/l. Five of the values recorded are well above the treatable concentration of 32.2 mg/l, attainable by the available treatment technology. In addition, ammonia is expected to be present based on its use in the raw materials. For these reasons, ammonia is selected for limitation in this subcategory.

Combined metals consists of the sum of gold, platinum, and palladium. This nonconventional pollutant parameter results from the information made available after promulgation of this rule. Petitioners were concerned with the variable nature of the production of gold, platinum, and palladium and the accuracy of analytical procedures for detecting these pollutants. Therefore, gold, platinum, and palladium were grouped into the one nonconventional pollutant parameter "combined metals".

Gold was analyzed for in 12 raw wastewater samples and was detected above its treatable concentration (0.01 mg/l) in all 12 samples. The concentrations ranged from 0.086 to 40 mg/l. Six of the 12 samples were found to contain more than 1 mg/l of gold. In addition, gold is expected to be present in wastewaters from this subcategory due to its presence in the raw materials and products. Platinum and palladium were not analyzed for in any raw wastewater samples from this subcategory. However, they are expected to be present in the raw wastewater in concentrations exceeding that achievable by treatment (0.01 mg/l). The reason for expecting treatable concentrations of platinum and palladium is they are both present in the raw materials and in the products produced by plants in this subcategory. For these reasons, combined metals are selected for limitations in this subcategory.

Oil and grease was analyzed for in 20 samples and was detected below quantifiable levels 11 times. In only two cases was oil and grease detected above its treatable concentration of 10 mg/l. The two treatable values are 14 mg/l and 37 mg/l and they are both for samples of refinery wet air pollution control. However, five other samples of this waste stream show oil and grease well below treatability. Because of the small number of sources in which oil and grease was detected above its treatable concentration, oil and grease is not selected for limitation in this subcategory.

Total suspended solids (TSS) concentrations ranging from 0 to 5,600 mg/l were observed in the 20 samples analyzed for this study. Nineteen of 20 samples exhibited concentrations above the concentration attainable by the identified treatment technology (2.6 mg/l). Furthermore, most of the specific methods for removing priority metals do so by precipitation, and the metal precipitates should not be discharged. Meeting a limitation on TSS also aids in removal of precipitated priority metals. For these reasons, total suspended solids are selected for limitation in this subcategory.

The pH values observed in 14 of 20 samples were outside the 7.5 to 10.0 range considered desirable for discharge to receiving waters. Six pH values ranged from 0.1 to 3.4. Six samples ranged from 5.9 to 9.3. The remaining eight samples ranged from

10.9 to 12.6. Effective removal of priority metals by chemical precipitation requires careful control of pH. Therefore, pH is selected for limitation in this subcategory.

TOXIC PRIORITY POLLUTANTS

The frequency of occurrence of the toxic pollutants in the raw wastewater samples taken is presented in Table VI-1 (page 2514). These data provide the basis for the categorization of specific pollutants, as discussed below. Table Vi-1 is based on the raw wastewater data from streams 200, 189, 5, 201, 187, 4, 821, 233, 230, 228, 6, 701, 702, and 703 (see Section V). Treatment plant samples were not considered in the frequency count.

TOXIC POLLUTANTS NEVER DETECTED

The priority pollutants listed in Table VI-2 (page 2518) were not detected in any wastewater samples from this subcategory; therefore, they are not selected for consideration in establishing limitations:

TOXIC POLLUTANTS NEVER FOUND ABOVE THEIR ANALYTICAL QUANTIFICATION LIMIT

The priority pollutants listed below were never found above their analytical quantification concentration in any wastewater samples from this subcategory; therefore, they are not selected for consideration in establishing limitations.

4. benzene
7. chlorobenzene
10. 1,2-dichloroethane
21. 2,4,6-trichlorophenol
24. 2-chlorophenol
34. 2,4-dimethylphenol
44. methylene chloride (dichloromethane)
47. bromoform (tribromomethane)
48. dichlorobromomethane
51. chlorodibromomethane
54. isophorone
62. N-nitrosodiphenylamine
68. di-n-butyl phthalate
69. di-n-octyl phthalate
70. diethyl phthalate
71. dimethyl phthalate
86. toluene

PRIORITY POLLUTANTS PRESENT BELOW CONCENTRATIONS ACHIEVABLE BY TREATMENT

The pollutants listed below are not selected for consideration in establishing limitations because they were not found in any wastewater samples from this subcategory above concentrations considered achievable by existing or available treatment technologies. These pollutants are discussed individually following the list.

57. 2-nitrophenol 123. mercury

2-Nitrophenol was found in only one sample at its quantification limit. The reported concentration was 0.01 mg/l, which is also the treatable concentration. Since the pollutant was not detected above the concentration attainable by identified treatment technology, 2-nitrophenol is not considered for limitation.

Mercury was detected below its quantification limit in 20 out of 24 samples analyzed. The four values reported above the quantification limit ranged from 0.0003 mg/l to 0.015 mg/l, which are all below the concentration attainable by identified treatment technology, which is 0.036 mg/l. Therefore, mercury is not considered for limitation.

PRIORITY POLLUTANTS DETECTED IN A SMALL NUMBER OF SOURCES

The following pollutants were not selected for limitation on the basis that they are detectable in the effluent from only a small number of sources within the subcategory and they are uniquely related to only those sources.

6. carbon tetrachloride
11. 1,1,1-trichloroethane
23. chloroform
65. phenol
66. bis(2-ethylhexyl) phthalate
117. beryllium

Although these pollutants were not selected for consideration in establishing nationwide limitations, it may be appropriate, on a case-by-case basis, for the local permittee to specify effluent limitations.

Carbon tetrachloride was detected in only one of 12 samples analyzed, at a concentration of 0.21 mg/l. The treatability concentration is 0.01 mg/l for this pollutant. Since it was not detected in 11 other samples, the measurement may be regarded as specific to the site and not characteristic of the subcategory as a whole. Also, carbon tetrachloride cannot be attributed to specific materials and processes used in the secondary precious metals subcategory. Therefore, carbon tetrachloride is not considered for limitation.

1,1,1-Trichloroethane was detected in only one of 12 samples analyzed, at a concentration of 0.015 mg/l. The treatability concentration is 0.01 mg/l for this pollutant. Since it was not detected in 11 other samples, the measurement may be regarded as specific to the site and not characteristic of the subcategory as a whole. Also, 1,1,1-trichloroethane cannot be attributed to specific materials and processes used in the secondary precious metals subcategory. Therefore, 1,1.1-trichloroethane is not considered for limitation.

Chloroform was detected in four of 12 samples above its treatable concentration of 0.01 mg/l. The four concentrations are all 0.02 mg/l. All four samples have a lower concentration of chloroform than the source water at the plant (0.05 mg/l). Chloroform cannot be attributed to specific materials or processes used in the subcategory, and very little removal of this pollutant can be expected with treatment. Therefore, chloroform is not considered for limitation.

Phenol was detected in only four of 12 samples above its treatable concentration of 0.01 mg/l. The four concentrations are 0.013 mg/l, 0.17 mg/l, 0.45 mg/l, and 0.65 mg/l. The three samples with concentrations above 0.10 mg/l were all taken at one plant which was shut down indefinitely subsequent to being sampled. Since phenol was not detected above its treatable concentration in eight other samples, the measurements may be regarded as specific to the site and not characteristic of the subcategory as a whole. Phenol cannot be attributed to specific materials and processes used in the secondary precious metals subcategory. Also, because of the relatively low concentrations of phenol in the raw waste compared with its treatable concentration, very little removal of phenol can be expected with treatment. Therefore, phenol is not considered for limitation.

Bis(2-ethylhexyl) phthalate was found above its treatable concentration of 0.01 mg/l in six of 12 samples. The concentrations ranged from 0.02 mg/l to 0.1 mg/l. This pollutant is not associated with specific processes used in the secondary precious metals subcategory, but is commonly used as a plasticizer in laboratory and field sampling equipment. Since the presence of this pollutant may be attributed to sample contamination, bis(2-ethylhexyl) phthalate is not considered for limitation.

Beryllium was found in only one out of 24 samples analyzed above its treatable concentration of 0.20 mg/l. The sample had a concentration of 0.46 mg/l. Since it was not found above its treat. able concentration in 23 other samples, the measurement may be regarded as site-specific and not characteristic of the subcategory as a whole. Although beryllium may be part of a raw material, such as jewelry scrap, used in the secondary precious metals industry, all the wastewater samples analyzed from plants which process these raw materials showed beryllium present below treatable concentrations. Therefore, beryllium is not considered for limitation.

PRIORITY POLLUTANTS SELECTED FOR FURTHER CONSIDERATION IN ESTABLISHING LIMITATIONS AND STANDARDS

The priority pollutants listed below are selected for further consideration in establishing limitations and standards for this subcategory. The priority pollutants selected for further consideration for limitation are each discussed following the list.

114. antimony
115. arsenic
118. cadmium
119. chromium
120. copper
121. cyanide
122. lead
124. nickel
125. selenium
126. silver
127. thallium
128. zinc

Antimony was detected above its treatable concentration (0.47 mg/l) in seven of 24 samples. The quantifiable concentrations ranged from 0.19.mg/l to 5.2 mg/l. Since antimony was present in concentrations exceeding the concentrations achievable by identified treatment technology, it is selected for consideration for limitation.

Arsenic was detected above its treatable concentration (0.34 mg/l) in four of 24 samples. The quantifiable concentrations ranged from 0.025 mg/l to 2.4 mg/l. Since arsenic was present in concentrations exceeding the concentrations achievable by identified treatment technology, it is selected for consideration for limitation.

Cadmium was detected above its treatable concentration (0.049 mg/l) in 12 of 24 samples. The quantifiable concentrations ranged from 0.0029 mg/l to 7.6 mg/l. Since cadmium was present in concentrations exceeding the concentrations achievable by identified treatment technology, it is selected for consideration for limitation.

Chromium was detected above its treatable concentration (0.07 mg/l) in 15 of 24 samples. The quantifiable concentrations ranged from 0.012 mg/l to 22 mg/l. Since chromium was present in concentrations exceeding the concentrations achievable by identified treatment technology, it is selected for consideration for limitation.

Copper was detected above its treatable concentration (0.39 mg/l) in 15 of 23 samples. The quantifiable concentrations ranged from 0.016 mg/l to 5,000 mg/l. Since copper was present in concentrations exceeding the concentrations achievable by identified treatment technology, it is selected for consideration for limitation.

Cyanide (total) was detected above its treatable concentration (0.047 mg/l) in 17 of 24 samples. The quantifiable concentrations ranged from 0.09 mg/l to 9,897 mg/l. Since cyanide is used as a raw material, and was present in concentrations exceeding the concentrations achievable by identified treatment technology, it is selected for consideration for limitation.

Lead was detected above its treatable concentration (0.08 mg/l) in 17 of 24 samples. The quantifiable concentrations ranged from 0.02 mg/l to 0.7 mg/l. Since lead was present in concentrations exceeding the concentrations achievable by identified treatment technology. it is selected for consideration for limitation.

Nickel was detected above its treatable concentration (0.22 mg/l) in 17 of 24 samples. The quantifiable concentrations ranged from 0.008 mg/l to 890 mg/l. Since nickel was present in concentrations exceeding the concentrations achievable by identified treatment technology, it is selected for consideration for limitation.

Selenium was detected above its treatable concentration (0.20 mg/l) in three of 24 samples. The quantifiable concentrations ranged from 0.019 mg/l to 120 mg/l. Since selenium was present in concentrations exceeding the concentrations achievable by identified treatment technology, it is selected for consideration for limitation.

Silver was detected above its treatable concentration (0.07 mg/l) in 14 of 24 samples. The quantifiable concentrations ranged from 0.05 mg/l to 26 mg/l. Since silver was present in concentrations exceeding the concentrations achievable by identified treatment technology, it is selected for consideration for limitation.

Thallium was detected above its treatable concentration (0.34 mg/l) in four of 22 samples. The quantifiable concentrations ranged from 0.82 mg/l to 1.2 mg/l. Since thallium was present in concentrations exceeding the concentrations achievable by identified treatment technology, it is selected for consideration for limitation.

Zinc was detected above its treatable concentration (0.23 mg/l) in 18 of 23 samples. The quantifiable concentrations ranged from 0.11 mg/l to 10,000 mg/l. Since zinc is used in the cementation process, and was present in concentrations exceeding the concentrations achievable by identified treatment technology, it is selected for consideration for limitation.

Table VI-1

FREQUENCY OF OCCURRENCE OF PRIORITY POLLUTANTS
SECONDARY PRECIOUS METALS SUBCATEGORY
RAW WASTEWATER

Pollutant	Analytical Quantification Concentration (mg/l)(a)	Treatable Concentration (mg/l)(b)	Number of Streams Analyzed	Number of Samples Analyzed	ND	Detected Below Quantification Concentration	Detected Below Treatable Concentration	Detected Above Treatable Concentration
1. acenaphthene	0.010	0.01	6	12	12			
2. acrolein	0.010	0.01	6	12	12			
3. acrylonitrile	0.010	0.01	6	12	12			
4. benzene	0.010	0.01	6	12	10	2		
5. benzidine	0.010	0.01	6	12	12			
6. carbon tetrachloride	0.010	0.01	6	12	11			1
7. chlorobenzene	0.010	0.01	6	12	11	1		
8. 1,2,4-trichlorobenzene	0.010	0.01	6	12	12			
9. hexachlorobenzene	0.010	0.01	6	12	12			
10. 1,2-dichloroethane	0.010	0.01	6	12	11	1		
11. 1,1,1-trichloroethane	0.010	0.01	6	12	11			1
12. hexachloroethane	0.010	0.01	6	12	12			
13. 1,1-dichloroethane	0.010	0.01	6	12	12			
14. 1,1,2-trichloroethane	0.010	0.01	6	12	12			
15. 1,1,2,2-tetrachloroethane	0.010	0.01	6	12	12			
16. chloroethane	0.010	0.01	6	12	12			
17. bis(chloromethyl) ether	0.010	0.01	6	12	12			
18. bis(2-chloroethyl) ether	0.010	0.01	6	12	12			
19. 2-chloroethyl vinyl ether	0.010	0.01	6	12	12			
20. 2-chloronaphthalene	0.010	0.01	6	12	12			
21. 2,4,6-trichlorophenol	0.010	0.01	6	12	11	1		
22. parachlorometa cresol	0.010	0.01	6	12	12			
23. chloroform	0.010	0.01	6	12	6	1	1	4
24. 2-chlorophenol	0.010	0.01	6	12	11	1		
25. 1,2-dichlorobenzene	0.010	0.01	6	12	12			
26. 1,3-dichlorobenzene	0.010	0.01	6	12	12			
27. 1,4-dichlorobenzene	0.010	0.01	6	12	12			
28. 3,3'-dichlorobenzidine	0.010	0.01	6	12	12			
29. 1,1-dichloroethylene	0.010	0.01	6	12	12			
30. 1,2-trans-dichloroethylene	0.010	0.01	6	12	12			
31. 2,4-dichlorophenol	0.010	0.01	6	12	12			
32. 1,2-dichloropropane	0.010	0.01	6	12	12			
33. 1,3-dichloropropylene	0.010	0.01	6	12	12			
34. 2,4-dimethylphenol	0.010	0.01	6	12	11	1		
35. 2 -dinitrotoluene	0.010	0.01	6	12	12			

Table VI-1 (Continued)

FREQUENCY OF OCCURRENCE OF PRIORITY POLLUTANTS
SECONDARY PRECIOUS METALS SUBCATEGORY
RAW WASTEWATER

Pollutant	Analytical Quantification Concentration (mg/l)(a)	Treatable Concentration (mg/l)(b)	Number of Streams Analyzed	Number of Samples Analyzed	ND	Detected Below Quantification Concentration	Detected Below Treatable Concentration	Detected Above Treatable Concentration
36. 2,6-dinitrotoluene	0.010	0.01	6	12	12			
37. 1,2-diphenylhydrazine	0.010	0.01	6	12	12			
38. ethylbenzene	0.010	0.01	6	12	12			
39. fluoranthene	0.010	0.01	6	12	12			
40. 4-chlorophenyl phenyl ether	0.010	0.01	6	12	12			
41. 4-bromophenyl phenyl ether	0.010	0.01	6	12	12			
42. bis(2-chloroisopropyl) ether	0.010	0.01	6	12	12			
43. bis(2-chloroethoxy) methane	0.010	0.01	6	12	12			
44. methylene chloride	0.010	0.01	6	12	3	9		
45. methyl chloride	0.010	0.01	6	12	12			
46. methyl bromide	0.010	0.01	6	12	12			
47. bromoform	0.010	0.01	6	12	11	1		
48. dichlorobromomethane	0.010	0.01	6	12	10	2		
49. trichlorofluoromethane	0.010	0.01	6	12	12			
50. dichlorodifluoromethane	0.010	0.01	6	12	12			
51. chlorodibromomethane	0.010	0.01	6	12	11	1		
52. hexachlorobutadiene	0.010	0.01	6	12	12			
53. hexachlorocyclopentadiene	0.010	0.01	6	12	12			
54. isophorone	0.010	0.01	6	12	11	1		
55. naphthalene	0.010	0.01	6	12	12			
56. nitrobenzene	0.010	0.01	6	12	12			
57. 2-nitrophenol	0.010	0.01	6	12	7	4	1	
58. 4-nitrophenol	0.010	0.01	6	12	12			
59. 2,4-dinitrophenol	0.010	0.01	6	12	12			
60. 4,6-dinitro-o-cresol	0.010	0.01	6	12	12			
61. N-nitrosodimethylamine	0.010	0.01	6	12	12			
62. N-nitrosodiphenylamine	0.010	0.01	6	12	11	1		
63. N-nitrosodi-n-propylamine	0.010	0.01	6	12	12			
64. pentachlorophenol	0.010	0.01	6	12	12			
65. phenol	0.010	0.01	6	12	4	4		4
66. bis(2-ethylhexyl) phthalate	0.010	0.01	6	12	0	6		6
67. butyl benzyl phthalate	0.010	0.01	6	12	12			
68. di-n-butyl phthalate	0.010	0.01	6	12	2	10		
69. di-n-octyl phthalate	0.010	0.01	6	12	11	1		
70. diethyl phthalate	0.010	0.01	6	12	2	10		

Table VI-1 (Continued)

FREQUENCY OF OCCURRENCE OF PRIORITY POLLUTANTS
SECONDARY PRECIOUS METALS SUBCATEGORY
RAW WASTEWATER

Pollutant		Analytical Quantification Concentration (mg/l)(a)	Treatable Concentration (mg/l)(b)	Number of Streams Analyzed	Number of Samples Analyzed	ND	Detected Below Quantification Concentration	Detected Below Treatable Concentration	Detected Above Treatable Concentration
71. dimethyl phthalate		0.010	0.01	6	12	11	1		
72. benzo(a)anthracene		0.010	0.01	6	12	12			
73. benzo(a)pyrene		0.010	0.01	6	12	12			
74. 3,4-benzofluoranthene		0.010	0.01	6	12	12			
75. benzo(k)fluoranthene		0.010	0.01	6	12	12			
76. chrysene		0.010	0.01	6	12	12			
77. acenaphthylene		0.010	0.01	6	12	12			
78. anthracene	(c)	0.010	0.01	6	12	12			
79. benzo(ghi)perylene		0.010	0.01	6	12	12			
80. fluorene		0.010	0.01	6	12	12			
81. phenanthrene	(c)	0.010	0.01	6	12	12			
82. dibenzo(a,h)anthracene		0.010	0.01	6	12	12			
83. indeno(1,2,3-cd)pyrene		0.010	0.01	6	12	12			
84. pyrene		0.010	0.01	6	12	12			
85. tetrachloroethylene		0.010	0.01	6	12	12			
86. toluene		0.010	0.01	6	12	5	7		
87. trichloroethylene		0.010	0.01	6	12	12			
88. vinyl chloride		0.010	0.01	6	12	12			
114. antimony		0.100	0.47	14	24	0	15	2	7
115. arsenic		0.010	0.34	14	24	0	13	7	4
116. asbestos		10 MFL	10 MFL	0					
117. beryllium		0.010	0.20	14	24	0	17	6	1
118. cadmium		0.002	0.049	14	24	0	8	4	12
119. chromium		0.005	0.07	14	24	0	7	2	15
120. copper		0.009	0.39	13	23	0	0	8	15
121. cyanide	(d)	0.02	0.047	14	24	0	7	0	17
122. lead		0.020	0.08	14	24	0	4	3	17
123. mercury		0.0001	0.036	14	24	0	20	4	0
124. nickel		0.005	0.22	14	24	0	1	6	17
125. selenium		0.01	0.20	13	21	0	15	3	3
126. silver		0.02	0.07	14	24	0	9	1	14
127. thallium		0.100	0.34	13	22	0	18	0	4
128. zinc		0.050	0.23	13	23	0	1	4	18
129. 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD)				0					

Table VI-1 (Continued)

FREQUENCY OF OCCURRENCE OF PRIORITY POLLUTANTS
SECONDARY PRECIOUS METALS SUBCATEGORY
RAW WASTEWATER

(a) Analytical quantification concentration was reported with the data (see Section V).

(b) Treatable concentrations are based on performance of lime precipitation, sedimentation, and filtration.

(c) Reported together.

(d) Analytical quantification concentration for EPA Method 335.2, Total Cyanide Methods for Chemical Analysis of Water and Wastes, EPA 600/4-79-020, March 1979.

TABLE VI-2

TOXIC POLLUTANTS NEVER DETECTED

1. acenaphthene
2. acrolein
3. acrylonitrile
5. benzidene
8. 1,2,4-trichlorobenzene
9. hexachlorobenzene
12. hexachloroethane
13. 1,1-dichloroethane
14. 1,1,2-trichloroethane
15. 1,1,2,2-tetrachloroethane
16. chloroethane
17. bis(2-chloromethyl) ether (Deleted)
18. bis (2-chloroethyl) ether
19. 2-chloroethyl vinyl ether
20. 2-chloronaphthalene
22. parachlorometa cresol
25. 1,2-dichlorobenzene
26. 1,3-dichlorobenzene
27. 1,4-dichlorobenzene
28. 3,3'-dichlorobenzidine
29. 1,1-dichloroethylene
31. 2,4-dichlorophenol
32. 1,2-dichloropropane
33. 1,2-dichloropropylene (1,3-dichloropropene)
35. 2,4-dinitrotoluene
36. 2,6-dinitrotoluene
37. 1,2-diphenylhydrazine
38. ethylbenzene
39. fluoranthene
40. 4-chlorophenyl phenyl ether
41. 4-bromophenyl phenyl ether
42. bis(2-chloroisopropyl) ether
43. bis(2.choroethoxy) methane
45. methyl chloride (chloromethane)
46. methyl bromide (bromomethane)
49. trichlorofluoromethane (Deleted)
50. dichlorodifluoromethane (Deleted)
52. hexachlorobutadiene
53. hexachlorocyclopentadiene
55. naphthalene
56. nitrobenzene
58. 4-nitrophenol
59. 2,4-dinitrophenol
60. 4,6-dinitro-o-cresol
61. N-nitrosodimethylamine
63. N-nitrosodi-n-propylamine
64. pentachlorophenol
67. butyl benzyl phthalate

TABLE VI-2 (Continued)

TOXIC POLLUTANTS NEVER DETECTED

72. benzo (a)anthracene (1,2-benzanthracene)
73. benzo (a)pyrene (3,4-benzopyrene)
74. 3,4-benzofluoranthene
75. benzo(k)fluoranthene (11,12-benzofluoranthene)
76. chrysene
77. acenaphthylene
78. anthracene
79. benzo(ghi)perylene (1,11-benzoperylene)
80. fluorene
81. phenanthrene
82. dibenzo (a,h)anthracene (1,2,5,6-dibenzantnracene)
83. indeno (1,2,3-cd)pyrene (w,e,-o-phenylenepyrene)
84. pyrene
85. tetrachloroethylene
87. trichloroethylene
88. vinyl chloride (chloroethylene)
89. aldrin*
90. dieldrin*
91. chlordane*
92. 4,4'-DDT*
93. 4,4'-DDE(p,p'DDX)*
94. 4,4'-DDD(p,p TDE)*
95. a-endosulfan-Alpha*
96. b-endosulfan-Beta*
97. endosulfan sulfate*
98. endrin*
99. endrin aldehyde*
100. heptachlor*
101. heptachlor epoxide*
102. a-BHC-Alpha*
103. b-BHC-Beta*
104. r-BHC (lindane)-Gamma*
105. g-BHC-Delta*
106. PCB-1242 (Arochlor 1242)*
107. PCB-1254 (Arochlor 1254)*
108. PCB-1221 (Arochlor 1221)*
109. PCB-1232 (Arochlor 1232)*
110. PCB-1248 (Arochlor 1248)*
111. PCB-1260 (Arochlor 1260)*
112. PCB-1016 (Arochlor 1016)*
113. toxaphene*
116. asbestos
129. 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD)

+We did not analyze for these pollutants in samples of raw wastewater from this subcategory. These pollutants are not believed to be present based on the Agency's best engineering judgment which includes consideration of raw materials and process operations.

SECTION VII

CONTROL AND TREATMENT TECHNOLOGIES

The preceding sections of this supplement discussed the sources, flows, and characteristics of the wastewaters from secondary precious metals plants. This section summarizes the description of these wastewaters and indicates the level of treatment which is currently practiced by plants in the secondary precious metals subcategory for each waste stream.

CURRENT CONTROL AND TREATMENT PRACTICES

This section presents a summary of the control and treatment technologies that are currently being applied to each of the sources generating wastewater in this subcategory. As discussed in Section V, wastewater associated with the secondary precious metals subcategory is characterized by the presence of the toxic metal pollutants. free and complexed cyanide, ammonia, combined metals (gold, platinum, and palladium), and suspended solids. The raw (untreated) wastewater data for specific sources as well as combined waste streams are presented in Section V. Generally, these pollutants are present in each of the waste streams at concentrations above treatability, and these waste streams are commonly combined for treatment. Construction of one wastewater treatment system for combined treatment allows plants to take advantage of economies of scale and, in some instances, to combine streams of differing alkalinity to reduce treatment chemical requirements. Twenty-four plants in this subcategory currently have combined wastewater treatment systems, 20 have chemical precipitation and sedimentation, and one of these has chemical precipitation, sedimentation and pressure filtration. One plant currently strips ammonia with air, and eight plants currently treat for cyanide. Seven of the eight use alkaline oxidation, and one plant precipitates cyanide with ferrous sulfate. Three plants currently practice ion exchange for removal of gold, platinum, and palladium. Three options have been selected for consideration for BPT, BAT, NSPS, and pretreatment in this subcategory, based on combined treatment of these compatible waste streams.

FURNACE WET AIR POLLUTION CONTROL

Air emission sources in secondary precious metals furnace operations include incinerator and smelting furnaces. Eighteen secondary precious metals producers control air emissions using various methods. These are:

1. Dry baghouse - 11 plants, and
2. Wet scrubber - seven plants.

Priority organics, metals, cyanide, combined metals (gold, platinum, and palladium), and suspended solids are present at

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treatable concentrations in the wastewater produced by furnace wet air pollution control. Two plants producing this wastewater practice complete recycle. Two practice partial recycle (>90 percent). Three practice no recycle. Treatment methods used are:

1. No treatment - two plants, and
2. Chemical precipitation and sedimentation - three plants.

One plant producing this wastewater practices ion exchange end-of-pipe treatment.

RAW MATERIAL GRANULATION

Three of four plants reporting this waste stream discharge it. The three discharging plants do not practice recycle or treatment of this waste stream. The non-discharging plant practices total recycle.

SPENT PLATING SOLUTIONS

Spent or contaminated cyanide solutions from electroplating shops may have the precious metal values recovered by a precipitation or electrolytic process. The waste stream is characterized by treatable concentrations of priority organics and metals, free and complexed cyanide, combined metals (gold, platinum, and palladium), and TSS. Treatment methods for this wastewater consist of:

1. Total cyanide precipitation using ferrous sulfate - one plant,
2. Free cyanide destruction using alkaline oxidation - six plants,
3. Chemical precipitation and sedimentation - one plant, and
4. Contractor disposal - four plants.

Four plants that have cyanide pretreatment also have chemical precipitation and sedimentation end-of-pipe treatment. The plant which uses ferrous sulfate also uses alkaline oxidation for cyanide treatment.

One plant producing this wastewater practices ion exchange end-of-pipe treatment.

SPENT CYANIDE STRIPPING SOLUTIONS

Six plants use potassium or sodium cyanide solution to strip gold away from scrap. Four plants employ contractor disposal methods to achieve zero discharge of spent stripping solution. This wastewater contains priority metals, free and complexed cyanide, combined metals (gold, platinum, and palladium), and TSS above treatable concentrations. One of the two discharging plants destroys the free cyanide with chlorine gas (alkaline oxidation). The other plant destroys the free and complexed cyanide with ferrous sulfate, and then practices chemical precipitation and sedimentation.

One plant producing this wastewater practices ion exchange end-of-pipe treatment.

REFINERY WET AIR POLLUTION CONTROL

Scrubbers are used at 29 plants to control fumes from precipitation and filtration processes. Facilities can use acid scrubbers, alkali scrubbers, or both types of scrubbers. This wastewater contains treatable concentrations of priority metals, combined metals (gold, platinum, and palladium) and suspended solids. Twenty-one plants discharge this waste-water, six of which practice no recycle, and 15 of which practice recycle of 75 percent or more. Eight plants do not discharge this wastewater. Three of these plants practice 100 percent recycle, and five of them have this wastewater disposed of by a contractor.

At the 21 discharging plants, scrubber water is commonly combined with other process wastewater and treated in a central treatment facility. Treatment methods used are:

1. Chemical precipitation and sedimentation - seven plants;
2. Chemical precipitation, sedimentation, and filtration - one plant; and
3. No treatment - 13 plants.

Two plants producing this wastewater practice ion exchange end-of-pipe treatment.

GOLD SOLVENT EXTRACTION RAFFINATE AND WASH WATER

One plant recovers gold by a solvent extraction process, and generates a raffinate waste stream and a wash water waste stream. Priority metals and TSS are expected to be found at treatable levels in the raffinate and wash water. This waste stream is not recycled. Treatment before discharge consists of neutralization with caustic, but no solids are removed.

GOLD SPENT ELECTROLYTE

Wastewater discharges from electrolytic refining consist of spent electrolyte solution. Of the three plants practicing electrolytic refining, one discharges wastewater. This wastewater is expected to contain treatable concentrations of priority metals, ammonia, and TSS. This waste stream is for recycled. The one discharging plant practices chemical precipitation and sedimenta-tion of the spent electrolyte prior to discharge. The other two plants are zero discharge by means of contractor disposal.

GOLD PRECIPITATION AND FILTRATION

Nineteen of 28 plants which produce gold by dissolving gold-containing raw material in acid and then selectively precipitating it from solution discharge this waste stream. This wastewater contains priority metals, combined metals (gold, platinum, and palladium), ammonia and TSS above treatable concentrations. No plants reported recycling this waste stream. Treatment methods for this wastewater consist of:

1. Chemical precipitation and sedimentation - 10 plants;
2. Chemical precipitation, sedimentation, and filtration - one plant;
3. Contractor disposal - seven plants;
4. One hundred percent reuse - two plants; and
5. No treatment - eight plants.

Two plants producing this wastewater practice ion exchange end-of-pipe treatment.

PLATINUM PRECIPITATION AND FILTRATION

Fourteen of 18 plants which produce platinum by a dissolution and selective precipitation process discharge this waste stream. This wastewater is expected to contain priority metals, combined metals (gold, platinum, and palladium), ammonia, and TSS above treatable concentrations. No plants reported recycling this waste stream. Treatment methods for this wastewater consist of:

1. Chemical precipitation and sedimentation - 10 plants (one with ammonia air stripping);
2. Chemical precipitation, sedimentation, and filtration - one plant;
3. No treatment - three plants; and
4. Contractor disposal - four plants.

Two plants producing this wastewater practice ion exchange end-of-pipe treatment.

PALLADIUM PRECIPITATION AND FILTRATION

Fifteen of 20 plants which produce palladium by a dissolution and selective precipitation process discharge this waste stream. This wastewater should contain priority metals, combined metals (gold, platinum, and palladium), ammonia, and TSS above treatable concentrations. No plants reported recycling this waste stream. Treatment methods for this wastewater consist of:

1. Chemical precipitation and sedimentation - nine plants (one with ammonia air stripping);
2. Chemical precipitation, sedimentation, and filtration - one plant;
3. No treatment - five plants;
4. One hundred percent reuse - one plant; and
5. Contractor disposal - four plants.

Two plants producing this wastewater practice ion exchange end-of-pipe treatment.

OTHER PLATINUM GROUP METALS PRECIPITATION AND FILTRATION

Two of three plants using a wet chemistry technique to produce platinum group metals such as rhodium and iridium discharge this waste stream. This waste stream is expected to contain priority metals, ammonia and TSS. Treatment methods for this wastewater consist of:

1. Chemical precipitation and sedimentation - one plant,
2. No treatment - one plant, and
3. Contractor disposal - one plant.

SPENT SOLUTION FROM PGC SALT PRODUCTION

Three of the four plants which produce PGC salt from pure gold and potassium cyanide discharge excess cyanide solution. Two of the three dischargers chlorinate the wastewater to destroy free cyanide, one has no treatment in-place, and one practices chemical precipitation and sedimentation. The non-discharging plant achieves this status by contractor disposal. The untreated wastewater contains priority metals, free and complexed cyanide, combined metals (gold, platinum, and palladium) and TSS above treatable concentrations.

One plant producing this wastewater practices ion exchange end-of-pipe treatment.

EQUIPMENT AND FLOOR WASH

Three plants reported an equipment and floor wash waste stream and two of these plants discharge it. This wastewater contains priority metals, ammonia, and TSS above treatable concentrations.

No plants reported recycling this waste stream. Both discharging plants practice chemical precipitation and sedimentation. One of the two plants air strips ammonia. The nondischarging plant uses contractor disposal to achieve this status.

PRELIMINARY TREATMENT

As discussed in Section V, EPA agreed to add a new building block for the preliminary treatment process. This building block was not included in the promulgated rule because the Agency believed that the furnace wet air pollution control (FWAP) building block accounted for flows generated by the preparatory processing of basis materials required before these materials can be introduced into the main hydrometallurgical refining system. Wastewaters from this building block should include priority organics, metals, cyanide, combined metals (gold, platinum, and palladium), and suspended solids, all at treatable concentrations.

CONTROL AND TREATMENT OPTIONS CONSIDERED

Based on an examination of the wastewater sampling data, three control and treatment technologies that effectively control the pollutants found in secondary precious metals wastewaters were selected for evaluation. The effectiveness of these technologies is detailed in Section VII of Vol. I, and the technology options are discussed below.

OPTION A

Option A for the secondary precious metals subcategory requires treatment technologies to reduce pollutant mass. The Option A treatment scheme consists of ammonia steam stripping preliminary treatment applied to the combined stream of gold precipitation and filtration, platinum precipitation and filtration, palladium precipitation and filtration, other platinum group metal precipitation and filtration, and equipment and floor wash water; and cyanide precipitation preliminary treatment applied to the combined stream of spent plating solution, spent cyanide stripping solution, and spent solutions from PGC salt production. Preliminary treatment is followed by chemical precipitation and sedimentation (lime and settle) treatment applied to the combined stream of steam stripper effluent, cyanide precipitation effluent, and the combined stream of all other wastewater. Chemical precipitation is used to remove metals by the addition of lime or caustic followed by gravity sedimentation. Suspended solids are also removed by the process. End-of-pipe treatment consisting of ion exchange is included for removal of gold, platinum and palladium.

OPTION B

Option B for the secondary precious metals subcategory consists of ammonia steam stripping, cyanide precipitation, chemical precipitation, sedimentation and ion exchange technology considered in Option A plus control technologies to reduce the discharge of wastewater volume. Recycle of furnace and refinery scrubber water as well as raw material granulation water are the principal control mechanisms for flow reduction.

OPTION C

Option C for the secondary precious metals subcategory consists of the ammonia steam stripping, cyanide precipitation, in-process flow reduction, chemical precipitation, sedimentation and ion exchange technology considered in Option B plus multimedia filtration technology added in between the sedimentation and ion exchange steps of the Option B treatment scheme. Multimedia filtration is used to remove suspended solids, including precipitates of metals, beyond the concentration attainable by gravity sedimentation. The filter suggested is of the gravity, mixed media type, although other forms of filters such as rapid sand filters or pressure filters would perform satisfactorily. The addition of filters also provides consistent removal during periods in which there are rapid increases in flows or loadings of pollutants to the treatment system.

The Agency believes that it may be necessary for some facilities to use sulfide polishing in order to achieve the promulgated effluent limitations because of high zinc concentrations or complexing problems. Because the Agency believes that these situations will be the exception, rather than the rule, sulfide polishing is not specifically included as part of the model technology on which effluent limitations and performance standards are based. The Agency has, however, evaluated the cost associated with the use of sulfide polishing at secondary precious metals plants. After performing this evaluation, the Agency has concluded that sulfide polishing will result in a very small (less than 5 percent) incremental increase in wastewater treatment costs at a typical secondary precious metals facility

SECTION VIII

COSTS, ENERGY, AND NONWATER QUALITY ASPECTS

This section presents a summary of compliance costs for the secondary precious metals subcategory and a description of the treatment options and subcategory-specific assumptions used to develop these estimates. Together with the estimated pollutant reduction performance presented in Sections IX. X, XI, and XII of this supplement, these cost estimates provide a basis for evaluating each regulatory option. These cost estimates are also used in determining the probable economic impact of regulation on the subcategory at different pollutant discharge levels. In addition, this section addresses nonwater quality environmental impacts of wastewater treatment and control alternatives, including air pollution, solid wastes, and energy requirements, which are specific to the secondary precious metals subcategory.

TREATMENT OPTIONS FOR EXISTING SOURCES

As discussed in Section VII, three treatment options have been developed for existing secondary precious metals sources. The treatment schemes for each option are summarized below and schematically presented in Figures X-1 through X-3 (page 2592).

OPTION A

Option A consists of ammonia steam stripping and cyanide precipitation preliminary treatment (where required), and chemical precipitation, sedimentation and ion exchange end-of-pipe technology.

OPTION B

Option B consists of in-process flow reduction measures, ammonia steam stripping and cyanide precipitation preliminary treatment (where required), and chemical precipitation, sedimentation and ion exchange end-of-pipe technology. The in-process flow reduction measures consists of the recycle of furnace scrubber water and refinery scrubber water as well as raw material granulation water through holding tanks.

OPTION C

Option C requires the in-process flow reduction measures of Option B, ammonia steam stripping and cyanide precipitation preliminary treatment, and end-of-pipe treatment technology consisting of chemical precipitation, sedimentation, multimedia filtration, and ion exchange.

The Agency believes that it may be necessary for some facilities to use sulfide polishing in order to achieve the promulgated effluent limitations because of high zinc concentrations or

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complexing problems. Because the Agency believes that these situations will be the exception, rather than the rule, sulfide polishing is not specif-ically included as part of the model technology on which effluent limitations and performance standards are based. The Agency has, however, evaluated the cost associated with the use of sulfide polishing at secondary precious metals plants. After performing this evaluation, the Agency has concluded that sulfide polishing will result in a very small (less than 5 percent) incremental increase in wastewater treatment costs at a typical secondary precious metals facility.

COST METHODOLOGY

A detailed discussion of the methodology used to develop the compliance costs is presented in Section VIII of the General Development Document. Plant-by-plant compliance costs for the nonferrous metals manufacturing category calculate incremental costs above treatment already in place, necessary to comply with promulgated effluent limitations and standards and are presented in the administrative record supporting this regulation. The costs developed for the final regulation are presented in Tables VIII-1 and VIII-2 (page 2343)for direct and indirect dischargers in this subcategory, respectively.

(1) For overlap plants (i.e., secondary precious metals - secondary silver or secondary precious metals - secondary tungsten plants), costs and removal estimates are apportioned on a flow-weighted basis. The total flow used for flow-weighting costs includes recycled floor wash water, whereas the total flow used for flow-weighting removals does not include floor wash water.

(2) A flow allowance for floor washing is assumed for each plant of the basis of 1.0 liter per troy ounce of precious metals, including silver, produced in the refinery. The flow allowance is based on the rates reported by the three plants supplying information about this stream. Table V-13 (page 2372) shows water use rates of 14.2, 1.0, and 0.97 liters per troy ounce. The highest rate was omitted because it is more than 10 times the next highest rate. The flow allowance was based an the average of the two lower rates.

(3) Floor wash water is obtained by recycling wastewater treated by chemical precipitation and sedimentation for all options. The recycle ratio is equal to the flow of floor wash water divided by the total flow to treatment.

(4) If a plant has a precipitation and filtration operation for platinum, palladium, other platinum group metals (PGM), or silver (from photographic raw materials), we assume floor wash water requires ammonia stripping to meet the proposed ammonia limitations.

(5) All sludge produced from lime precipitation is expected to be nonhazardous. All sludge produced from cyanide precipitation is hazardous, under RCRA regulations.

(6) All precipitation and filtration wastewater (gold, platinum, palladium, or other PGM) are assumed to undergo cementation prior to entering waste treatment. Zinc cementation is assumed unless iron cementation is specifically noted as in-place. Costs for installing and operating a cementation system are not included in the cost estimates because cementation is not considered a wastewater treatment operation. Only the zinc or iron raw waste values are changed by operating a cementation process. The revised raw waste values impact a plant's waste treatment cost.

(7) Ammonia stripping costs for plants having less than 50 liters per hour of water requiring stripping are based on air stripping via agitation-aeration in the batch chemical precipitation tank instead of steam stripping. These costs include a blower, sparger and hood.

(8) Costs for ion exchange end-of-pipe treatment are completely offset by the gold, platinum, and palladium values recovered by this system.

NONWATER QUALITY ASPECTS

A general discussion of the nonwater quality aspects of the control and treatment options considered for the nonferrous metals category is contained in Section VIII of Vol. I. Nonwater quality impacts specific to the secondary precious metals subcategory, including energy requirements, solid waste and air pollution are discussed below.

ENERGY REQUIREMENTS

The methodology used for determining the energy requirements for the various options is discussed in Section VIII of the General Development Document. Energy requirements for the three options considered are estimated at 5.30 x 106 kwh/yr, 5.31 x 106 kwh/yr, and 5.48 x 106 kwh/yr for Options A, B, and C, respectively. Option B energy requirements are similar to those for Option A. Because less water is being treated, energy costs for lime and settle treatment are less; however, recycle equipment such as holding tanks and pumps require additional energy, offsetting the energy savings. Option C, which includes filtration, is estimated to increase energy consumption over Option B by approximately 1 percent. Option C represents roughly 8 percent of a typical plant's electrical energy usage. It is therefore concluded that the energy requirements of the treatment options considered will not have a significant impact on total plant energy consumption.

SOLID WASTE

Sludge generated in the secondary precious metals subcategory is due to the precipitation of metal hydroxides and cyanide using lime and other chemicals. Sludges associated with the secondary precious metals subcategory will necessarily contain quantities of priority metal pollutants. Wastes generated by secondary metal industries can be regulated as hazardous. However, the Agency examined the solid wastes that would be generated at secondary nonferrous metals manufacturing plants by the suggested treatment technologies and believes they are not hazardous wastes under the Agency's regulations implementing Section 3001 of the Resource Conservation and Recovery Act. The one exception to this is solid wastes generated by cyanide precipitation. These sludges are expected to be hazardous and this judgment was included in this study. None of the non-cyanide wastes are listed specifically as hazardous. Nor are they likely to exhibit a characteristic of hazardous waste. This judgment is made based on the recommended technology of lime precipitation, sedimentation, and filtration. By the addition of a small excess (5-10%) of lime during treatment, similar sludges, specifically priority metal bearing sludges, generated by other industries such as the iron and steel industry passed the Extraction Procedure (EP) toxicity test. (See 40 CFR $261.24.) Thus, the Agency believes that the wastewater sludge will similarly not be EP toxic if the recommended technology is applied.

Although it is the Agency's view that solid wastes generated as a result of these guidelines are not expected to be hazardous, generators of these wastes must test the waste to determine if the wastes meet any of the characteristics of hazardous waste (see 40 CFR $262.11).

If these wastes identified should be or are listed as hazardous, they will come within the scope of RCRA s "cradle to grave" hazardous waste management program, requiring regulation from the point of generation to point of final disposition. EPA's generator standards would require generators of hazardous nonferrous metals manufacturing wastes to meet containerization, labeling, recordkeeping, and reporting requirements; if plants dispose of hazardous wastes off-site, they would have to prepare a manifest which would track the movement of the wastes from the generator's premises to a permitted off-site treatment, storage, or disposal facility. See 40 CFR $262.20 [45 FR 33142 (May 19, 1980), as amended at 45 FR 86973 (December 31, 1980)]. The transporter regulations require transporters of hazardous waste to comply with the manifest system to assure that the wastes are delivered to a permitted facility. See 40 CFR $263.20 [45 FR 33151 (May 19, 1980), as amended at 45 FR 86973 (December 31, 1980)]. Finally, RCRA regulations establish standards for hazardous waste treatment, storage, and disposal facilities allowed to receive such wastes. See 40 CFR Part 464 [46 FR 2802 (January 12, 1981), 47 FR 32274 (July 26, 1982)].

Even if these wastes are not identified as hazardous, they still must be disposed of in compliance with the Subtitle D open dumping standards, implementing $4004 of RCRA. See 44 FR 53438 (September 13, 1979). The Agency has calculated as part of the costs for wastewater treatment the cost of hauling and disposing of these wastes.

The Agency estimates that the promulgated BPT regulation for secondary precious metals manufacturing facilities will generate 523 metric tons of solid wastes (wet basis) in 1982 as a result of wastewater treatment. Promulgated BAT will not significantly increase sludge generation, however promulgated PSES will add 1,585 metric tons of solid waste per year which includes 344 tons per year of cyanide bearing sludges from treatment of cyanide bearing wastewaters by cyanide precipitation.

AIR POLLUTION

There is no reason to believe that any substantial air pollution problems will result from implementation of ammonia steam stripping, cyanide precipitation, chemical precipitation, sedimentation, multimedia filtration and ion exchange. These technologies transfer pollutants to solid waste and are not likely to transfer pollutants to air.

TABLE VIII-1

COST OF COMPLIANCE FOR THE SECONDARY PRECIOUS METALS SUBCATEGORY DIRECT DISCHARGERS

The costs for this subcategory are not presented here because the data on which they are based are claimed to be confidential.

TABLE VIII-2

COST OF COMPLIANCE FOR THE SECONDARY PRECIOUS METALS SUBCATEGORY INDIRECT DISCHARGERS

(March, 1982 Dollars)

Option	Total Required Capital Cost	Total Annual Cost
A	1,774,400	1,078,000
B	1,707,000	1,034,000
C	1,809,400	1,100,500

SECTION IX

BEST PRACTICABLE CONTROL TECHNOLOGY CURRENTLY AVAILABLE

This section defines the effluent characteristics attainable through the application of best practicable control technology currently available (BPT), Section 301(b)(a)(A). BPT reflects the existing performance by plants of various sizes, ages, and manufacturing processes within the secondary precious metals subcategory, as well as the established performance of the model BPT systems. Particular consideration is given to the treatment already in place at plants within the data base.

The factors considered in identifying BPT include the total cost of applying the technology in relation to the effluent reduction benefits from such application, the age of equipment and facilities involved, the manufacturing processes employed, nonwater quality environmental impacts (including energy requirements), and other factors the Administrator considers appropriate. In general the BPT level represents the average to the existing performances of plants of various ages, sizes, processes, or other common characteristics. Where existing performance is uniformly inadequate, BPT may be transferred from a different subcategory or category. Limitations based on transfer of technology are supported by a rationale concluding that the technology is indeed, transferable, and a reasonable prediction that it will be capable of achieving the prescribed effluent limits (see Tanner's Council of America v. Train. 540 F.2d 1188 (4th Cir. 1176)). BPT focuses on end-of-pipe treatment rather than process changes or internal controls, except where such practices are common within the subcategory.

TECHNICAL APPROACH TO BPT

The Agency studied the nonferrous metals category to identify the processes used the wastewaters generated, and the treatment processes installed. Information was collected from the category using data collection portfolios, and specific plants were sampled and the wastewaters analyzed. In making technical assessments of data, reviewing manufacturing processes, and assessing wastewater treatment technology options, both indirect and direct dischargers have been considered as a single group. An examination of plants and processes did not indicate any process differences based on the type of discharge, whether it be direct or indirect.

As explained in Section IV, the secondary precious metals subcategory has been subdivided into 14 potential wastewater sources. Since the water use, discharge rates, and pollutant characteristics of each of these wastewaters is potentially unique, effluent limitations have been developed for each of the 14 building blocks.

For each of the subdivisions, a specific approach was followed for the development of BPT mass limitations. The first requirement to calculate these limitations is to account for production and flow variability from plant to plant. Therefore, a unit of production or production normalizing parameter (PNP) was determined for each waste stream which could then be related to the flow from the process to determine a production normalized flow. Selection of the PNP for each process element is discussed in Section IV. Each plant within the subcategory was then analyzed to determine which subdivisions were present, the specific flow rates generated for each subdivision, and the specific production normalized flows for each subdivision. This analysis is discussed in detail in Section V. Nonprocess wastewaters such as rainfall runoff and noncontact cooling water are not considered in the analysis.

Production normalized flows were then analyzed to determine the flow to be used as part of the basis for BPT mass limitations. The selected flow (sometimes referred to as the BPT regulatory flow or BPT discharge rate) reflects the water use controls which are common practices within the category. The BPT regulatory flow is based on the average to all applicable data. Plants with normalized flows above the average may have to implement some method of flow reduction to achieve the BPT limitations.

The second requirement to calculate mass limitations is the set of concentrations that are achievable by application of the BPT level of treatment technology. Section VII discusses the various control and treatment technologies which are currently in place for each wastewater source. In most cases, the current control and treatment technologies consist of chemical precipitation and sedimentation (lime and settle) technology and a combination of reuse and recycle to reduce flow. Ammonia steam stripping is applied to streams with treatable concentrations of ammonia. Cyanide precipitation is applied to streams with treatable concentrations of free and complexed cyanide. Ion exchange is applied as an effluent polishing step to reduce combined metals (gold, platinum, and palladium), and palladium concentrations.

Using these regulatory flows and the achievable concentrations, the next step is to calculate mass loadings for each wastewater source or subdivision. This calculation was made on a stream-by-stream basis, primarily because plants in this subcategory may perform one or more of the operations in various combinations.

The mass loadings (milligrams of pollutant per troy ounce of production - mg/T.O.) were calculated by multiplying the BPT regulatory flow (l/T.O.) by the concentration achievable by the BPT level of treatment technology (mg/l) for each pollutant parameter to be limited under BPT. These mass loadings are published in the Federal Register and in CFR Part 421 as the effluent limitations guidelines.

The mass loadings which are allowed under BPT for each plant will be the sum of the individual mass loadings for the various wastewater sources which are found at particular plants. Accordingly, all the wastewater generated within a plant may be combined for treatment in a single or common treatment system, but the effluent limitations for these combined wastewaters are based on the various wastewater sources which actually contribute to the combined flow. This method accounts for the variety of combinations of wastewater sources and production processes which may be found at secondary precious metals plants.

The Agency usually establishes wastewater limitations in terms of mass rather than concentration. This approach prevents the use of dilution as a treatment method (except for controlling pH). The production normalized wastewater flow (l/T.O.) is a link between the production operations and the effluent limitations. The pollutant discharge attributable to each operation can be calculated from the normalized flow and effluent concentration achievable by the treatment technology and summed to derive an appropriate limitation for each plant.

INDUSTRY COST AND POLLUTANT REMOVAL ESTIMATES

In balancing costs in relation to pollutant removal estimates, EPA considers the volume and nature of existing discharges, the volume and nature of discharges expected after application of BPT, the general environmental effects of the pollutants, and the cost and economic impacts of the required pollution control level. The Act does not require or permit consideration of water quality problems attributable to particular point sources or industries, or water quality improvements in particular water quality bodies. Accordingly, water quality considerations were not the basis for selecting the proposed or promulgated BPT. See Weyerhaeuser Company v. Costle, 590 F.2d 1011 (D.C. Cir. 1978).

The methodology for calculating pollutant removal estimates and plant compliance costs is discussed in Section X. The pollutant removal estimates have been revised since proposal based on comments and on new data. Tables X-2 and XII-1 (pages 2574 and 2619) show the estimated pollutant removals for each treatment option for direct and indirect dischargers. Compliance costs are presented in Tables X-3 and XII-2 (pages 2575 and 2620).

BPT OPTION SELECTION

The technology basis for the BPT limitations is Option A, chemical precipitation and sedimentation technology to remove metals and solids from combined wastewaters and to control pH, ammonia steam stripping to remove ammonia, cyanide precipitation to remove free and complexed cyanide and ion exchange to remove gold, platinum and palladium. The promulgated technology is equivalent to the proposed technology with the addition of ion exchange. Chemical precipitation and sedimentation technology is already in-place at 20 of the plants in the subcategory including all four direct dischargers. One plant has cyanide precipitation in-place. Three plants currently practice ion exchange. The technology bases for steam stripping and cyanide precipitation are discussed below. The pollutants specifically proposed for regulation at BPT are copper, cyanide, zinc, ammonia, combined metals (gold, platinum, and palladium), TSS, and pH. The Agency believes that it may be necessary for some facilities to use sulfide polishing in order to achieve the promulgated effluent limitations because of high zinc concentrations or complexing problems. Because the Agency believes that these situations will be the exception, rather than the rule, sulfide polishing is not specifically included as part of the model technology on which the BPT effluent limitations are based. The Agency has, however, evaluated the cost associated with the use of sulfide polishing at secondary precious metals plants. After performing this evaluation, the Agency has concluded that sulfide polishing will result in a very small (less than 5 percent) incremental increase in wastewater treatment costs at a typical secondary precious metals facility.

Implementation of the promulgated BPT limitations will remove annually an estimated 34,634 kg of priority pollutants (which includes 6.3 kg of cyanide), 490 kg of ammonia, and 18,420 kg of TSS.

The compliance costs for this subcategory are not presented here because the data on which they are based have been claimed to be confidential. The Agency has determined that the benefits justify the costs for this subcategory.

More stringent technology options were not selected for BPT since they require in-process changes end-of-pipe technologies less widely practiced in the subcategory, and, therefore, are more appropriately considered under BAT.

In response to a comment about high zinc concentrations in raw wastewater, EPA has included sulfide precipitation as a polishing step to treat high zinc concentrations in secondary precious metals wastewaters. The Agency concluded that the addition of sulfide precipitation would add only approximately 4 percent to the total annual costs for wastewater treatment at a typical secondary precious metals plant. Although not including it in the BPT treatment scheme, the Agency has no doubt that the CMDB concentrations could be achieved by secondary precious metals plants using sulfide polishing.

Ammonia steam stripping is demonstrated at six facilities in the nonferrous metals manufacturing category. These facilities are treating ammonia-bearing wastewaters associated with the production of primary tungsten, primary columbium and tantalum, primary molybdenum, secondary tungsten and cobalt, and primary zirconium and hafnium. EPA believes that performance data from the iron and steel manufacturing category provide a valid measure of this technology's performance on nonferrous metals manufacturing category wastewater because raw wastewater concentrations of ammonia are of the same order of magnitude in the respective raw wastewater matrices.

Chemical analysis data were collected of raw waste (treatment influent) and treated waste (treatment effluent) from one coke plant of the iron and steel manufacturing category. Using EPA sampling and chemical analysis protocols, six paired samples were collected in a two-month period. These data are the data base for determining the effectiveness of ammonia steam stripping technology. Ammonia treatment at this coke plant consisted of two steam stripping columns in series with steam injected countercurrently to the flow of the wastewater. A lime reactor for pH adjustment separated the two stripping columns.

The Agency has verified the proposed steam stripping performance values using steam stripping data collected at a primary zirconium and hafnium plant which has raw ammonia levels as high as any in the nonferrous metals manufacturing category. Data collected by the plant represent almost two years of daily operations, and support the long-term mean used to establish treatment effectiveness. Also, data from a bench scale treatability study which was submitted with comments on the proposed rulemaking show that the proposed steam stripping performance can be achieved with secondary precious metals wastewaters.

Cyanide precipitation is demonstrated in the secondary precious metals subcategory at one plant. Cyanide precipitation technology is required for the secondary precious metals subcategory because existing treatment within the subcategory does not effectively remove cyanide. Most secondary precious metals plant use alkaline oxidation to destroy free cyanide, but do not effectively remove complexed cyanide. Cyanide precipitation is directed at control of free and complexed cyanides in waste streams within the secondary precious metals subcategory. This subcategory collectively discharges approximately 557 kg/yr of cyanide. The achievable performance is transferred from three well-operated coil coating plants in the coil coating category, and are contained within the public record supporting this document. The Agency believes this technology, and the achievable concentration limits, are transferable to the secondary precious metals subcategory because raw wastewater cyanide concentrations (prior to dilution with waste streams without cyanide) are of the same order of magnitude in both categories. Further, no pollutants were identified in secondary precious metals wastewater that would interfere with the operation or performance of this technology.

Several discharging plants within the secondary precious metals subcategory use chlorine gas or hypochlorite solution to oxidize cyanide in their wastewater. EPA considered chemical oxidation using chlorine. Although the chlorine oxidation process can be used effectively for wastewater containing predominantly free cyanides and easily oxidizable cyanide complexes, the Agency determined that precipitation with ferrous sulfate is more effective than chlorine oxidation for the removal of iron-cyanide complexes which may be found in the secondary precious metals wastewater.

WASTEWATER DISCHARGE RATES

A BPT discharge rate is calculated for each subdivision based on the average of the flows of the existing plants, as determined from analysis of the dcp. The discharge rate is used with the achievable treatment concentrations to determine BPT effluent limitations. Since the discharge rate may be different for each wastewater source, separate production normalized discharge rates for each of the 14 wastewater sources are discussed below and summarized in Table IX-1 (page 2546). The discharge rates are normalized on a production basis by relating the amount of wastewater generated to the mass of the intermediate product which is produced by the process associated with the waste stream in question. These production normalizing parameters, or PNPs, are also listed in Table IX-1.

Section V of this supplement further describes the discharge flow rates and presents the water use and discharge flow rates for each plant by subdivision.

FURNACE WET AIR POLLUTION CONTROL

The BPT wastewater discharge rate proposed and promulgated for furnace wet air pollution control is 71.8 liters per troy ounce of precious metals, including silver, incinerated or smelted, based on zero percent recycle. This rate is allocated only for plants practicing wet air pollution control for the furnace. Seven plants reported this wastewater, two of whom practice 100 percent recycle (plants 1094 and 1084). The BPT rate is based on the average water use rate of four of the remaining five plants. Plant 1105 was omitted because its water use rate was not reported, and its recycle rate was not quantified. The BPT rate is the average of 137, 116, 27.6, and 7.26 liters per troy ounce. The distribution of wastewater rates for this waste stream is presented in Section V (Table V-1, page 2360).

RAW MATERIAL GRANULATION

The BPT wastewater discharge rate promulgated for raw material granulation is 6.34 liters per troy ounce of precious metals in the granulated raw material. This rate is different than the proposed rate, which was 0 liters per troy ounce. Based on comments received following proposal, the Agency determined that a discharge is necessary for raw material granulation water. The promulgated BPT rate is based on the average of the rates reported by two of the three plants whose production normalized water use rates are quantified, plants 1008 and 1094. As shown in Table V-2 (page 2361), these rates are 8.67 and 4.0 liters per troy ounce, respectively. The production normalized flow rate for plant 1112 was not included in the calculation of the BPT discharge rate for this subdivision as discussed at the front of this section.

SPENT PLATING SOLUTIONS

The BPT wastewater discharge rate proposed and promulgated for spent plating solutions is 1.0 liter per liter of spent plating solution raw material. This rate is applicable to those plants which recover gold and other precious metals from spent or contaminated electroplaters solutions which they receive as a raw material. The discharge rate is given in terms of volume of raw material because EPA believes plants cannot control the concentration of precious metals in this raw material, and should be allowed to discharge the entire volume of solution coming into the plant, after recovering the precious metals. Only the volume of raw material solution should be allowed to be discharged, and this is why a discharge rate of 1.0 liter per liter was selected. The 12 plants with this subdivision are shown in Table V-3 (page 2362).

SPENT CYANIDE STRIPPING SOLUTIONS

The BPT wastewater discharge rate promulgated for spent cyanide stripping solutions is 3.7 liters per troy ounce of gold recovered by cyanide stripping. This rate applies to plants which recover gold by stripping it from a raw material such as electronic scrap, with a cyanide-based solution, and then recovering the gold from this solution. This rate is based on the average of the lower five of six water use rates reported for this stream in Table V-4 (page 2363). Plant 1100 was omitted because of its excessive water use. EPA proposed 1.1 liters per troy ounce for this waste stream, but stated that it was considering 4.7 liters per troy ounce and would select between the two based on a variety of factors, including public comment. EPA decided to revise the rate from 1.1 to 3.7 liters per troy ounce for promulgation based on comments received following proposal.

REFINERY WET AIR POLLUTION CONTROL

The BPT wastewater discharge rate proposed and promulgated for refinery wet air pollution control is 21.0 liters per troy ounce of precious metals, including silver, produced in the refinery, based on zero percent recycle. This rate applies to either acid or alkaline scrubbers. If both acid and alkaline scrubbers are present in a particular facility, the same rate applies to each. This rate is allocated only for plants practicing wet air pollution control for acid or cyanide fumes in the refinery. Twenty-eight plants reported this waste stream, five of which practice zero percent recycle and discharge the wastewater (107, 42, 32.8, 6.8, and 2.4 liters per troy ounce). The BPT rate is based on the average of the lower four of these five dischargers. The highest flow rate (107 liters per troy ounce) was omitted from the BPT rate calculation because there is no reason to believe this much water is needed for this operation in light of rates from the other plants. Table V-5 (page 2364) shows the distribution of water use and discharge rates for refinery wet air pollution control. The production normalized flow rate for plant 1112 was not included in the calculation of the BPT discharge rate for this subdivision as discussed at the front of this section.

GOLD SOLVENT EXTRACTION RAFFINATE AND WASH WATER

The BPT wastewater discharge rate proposed and promulgated for gold solvent extraction raffinate and wash water is 0.63 liters per troy ounce of gold recovered by solvent extraction. This discharge rate is allocated only to plants which refine gold by a solvent extraction process. The discharge rate is based on the rate reported by the only plant with this process (0.63 liters per troy ounce), as shown in Table V-6 (page 2366).

GOLD SPENT ELECTROLYTE

The BPT wastewater discharge rate proposed and promulgated for gold spent electrolyte is 0.0087 liters per troy ounce of gold recovered by electrolysis. This rate only applies to plants which refine gold by electrolysis. The discharge rate is based on the lower of the two rates reported for this wastewater stream (0.0087 liters per troy ounce), as shown in Table V-7 (page 2366). The other flow rate (0.294 liters per troy ounce) is more than 10 times higher than the selected BPT rate.

GOLD PRECIPITATION AND FILTRATION

The BPT wastewater discharge rate proposed and promulgated for gold precipitation and filtration is 4.4 liters per troy ounce of gold precipitated. This rate only applies to plants which refine gold by dissolving gold-containing raw material in acid, and then recovering gold by precipitation. This discharge rate is based on the final or net quantity of gold produced using this process, not the amount precipitated through each refining step. Of the 28 plants using this process, nine plants supplied insufficient information to calculate discharge rates, two plants report 100 percent reuse of this water, and six plants do not discharge this waste stream by means of contract hauling (these plants have water use rates of 560.5, 69.1, 3.34, 0.815, 0.63, and 0.05 liters per troy ounce). The BPT discharge rate is based on the average water use rate of 10 of the 11 discharging plants (24.3, 7.98, 4.1, 2.65, 2.5, 1.86, 0.341, 0.312. 0.27, and 0.144 liters per troy ounce). The plant reporting 404 liters per troy ounces rate was not considered in the average because this water use rate is almost 10 times that of the next highest plant. Eight of the discharging plants meet the BPT rate. Water use and discharge rates are presented in Table V-8 (page 2367).

PLATINUM PRECIPITATION AND FILTRATION

The BPT wastewater discharge rate proposed and promulgated for platinum precipitation and filtration is 5.2 liters per troy ounce of platinum precipitated. This rate only applies to plants which refine platinum by dissolving it in acid or base, and recover it by precipitation. This discharge rate is based on the final or net quantity of metal produced using this process, not the amount precipitated through each refining step. Of the 18 plants using this process, 13 supplied insufficient information to calculate discharge rates. Five plants reported sufficient data (354, 30.2, 10.4, 4.5, and 0.58 liters per troy ounce). Table V-9 (page 2369) presents the water use and discharge rates for this waste stream. The BPT discharge rate is based on the average of the three lowest water use rates. The 354 and 30.2 liters per troy ounce water use rates were omitted from the average because there is no reason to believe this much water is needed for this operation in light of the rates from the other plants.

PALLADIUM PRECIPITATION AND FILTRATION

The BPT wastewater discharge rate proposed and promulgated for palladium precipitation and filtration was 3.5 liters per troy ounce of palladium precipitated. As a result of the settlement agreement, EPA is proposing to modify the flow rate from the palladium precipitation and filtration building block from 3.5 to 6.0 liters per troy ounce of precious metals produced. This change reflects a recalculation of the average flow for this building block and the incorporation of new data. This rate only applies to plants which refine palladium by dissolving it in acid or base, and then recovering it by precipitation. This discharge rate is based on the final or net quantity of metal produced using this process, not the amount precipitated through each refining step.

OTHER PLATINUM GROUP METALS PRECIPITATION AND FILTRATION

The BPT wastewater discharge rate proposed and promulgated for other platinum group metals (rhodium, iridium, osmium, and ruthenium) precipitation and filtration is 5.2 liters per troy ounce of platinum group metals precipitated. This rate only applies to plants which refine these metals by dissolving them in either acid or base, and then precipitating them. This discharge rate is based on the final or net quantity of metal produced using this process, not the amount precipitated through each refining step. Three plants use this process and none reported sufficient information to calculate water use or discharge rates. This is shown in Table V-11. The BPT discharge rate is therefore based on the platinum precipitation and filtration BPT discharge rate derived from Table V-9. These two subdivisions are expected to have similar flows because all five metals (platinum, rhodium, iridium, osmium, and ruthenium) are part of the platinum group, and all are refined in a similar manner.

SPENT SOLUTION FROM PGC SALT PRODUCTION

The BPT wastewater discharge rate proposed and promulgated for spent solution from the PGC salt production process is 0.9 liters per troy ounce of gold contained in PGC product. This rate applies only to plants which manufacture a potassium gold cyanide salt product by reacting pure gold with potassium cyanide solution. There are four plants reporting this process, as shown in Table V-12 (page 2371). The plant reporting 260 liters per troy ounce explained that part to that water is used in a scrubber above the reaction vessel, and the two flow rates (discharging excess solution and scrubber liquor) could not be separated. It is likely that most of that plant's water discharge is due to the scrubber. The plant reporting 0.9 liters per troy ounce confirmed that its water discharge was due entirely to the excess reaction solution. Because the data from the plant reporting 260 liters per troy ounce could not be apportioned between scrubber liquor and spent solution, the BPT wastewater discharge is based upon 0.9 liters per troy ounce. The production normalized flow rate for plant 1112 was not included in the calculation of the BPT discharge rate for this subdivision as discussed at the front of this section.

EQUIPMENT AND FLOOR WASH

The BPT wastewater discharge rate proposed and promulgated for equipment and floor wash is 0 liters per troy ounce of precious metals, including silver, produced in the refinery. The BPT discharge rate is based on recycle of treated effluent for use as raw water for equipment and floor wash. In precious metals refineries, EPA realizes there is a possibility of accidental leaks and spills, which may contain precious metals and silver, and need to be recovered by washing the equipment and the floor. We believe that wastewater treatment plant effluent can be recycled for this purpose, increasing the capacity of treatment but not the actual amount of water discharged.

PRELIMINARY TREATMENT

As discussed in Sections V and VII, EPA agreed to establish BPT limitations for a new building block, preliminary treatment, for the secondary precious metals subcategory. The BPT water discharge rate for this block is 50 liters per troy ounce of precious metal produced. The flow basis is based on information that is considered confidential.

REGULATED POLLUTANT PARAMETERS

The raw wastewater concentrations from individual operations and the subcategory as a whole were examined to select certain pollutant parameters for limitation. This examination and evaluation was presented in Section VI. Seven pollutant or pollutant parameters selected for limitation under BPT and are listed below:

120. copper
121. cyanide
128. zinc
ammonia (as N)
combined metals (gold, platinum, and palladium)
total suspended solids (TSS)

pH

EFFLUENT LIMITATIONS

The concentrations achievable by application of the promulgated BPT treatment are explained in Section VII of Vol. I and summarized there in Table VII-21 (page 248). The achievable treatment concentrations (both one-day maximum and monthly average values) are multiplied by the BPT normalized discharge flows summarized in Table IX-1 (page 2546) to calculate the mass of pollutants allowed to be discharged per mass of product. The results of these calculations in milligrams of pollutant per troy ounce of product represent the BPT effluent limitations and are presented in Table IX-2 (page 2548) for each individual building block.

TABLE IX-1

BPT WASTEWATER DISCHARGE RATES FOR THE SECONDARY PRECIOUS METALS SUBCATEGORY

Wastewater Stream	BAT Normalized Discharge Rates	Production Normalizing Parameter
Furnace wet air pollution control	4.5 l/t.o.	Troy ounces of precious metals, including silver, incinerated or smelted
Raw material granulation	0.64 l/t.o.	Troy ounces of precious metals in the granulated raw material
Spent plating solutions	1.1 l/l	Liters of spent plating solution used as a raw material
Spent cyanide stripping solutions	3.7 l/t.o.	Troy ounces of gold stripped
Refinery wet air pollution control	1.0 l/t.o.	Troy ounces of precious metals produced in refinery, including silver
Gold solvent extraction raffinate	0.63 l/t.o.	Troy ounces of gold produced by solvent extraction
Gold spent electrolyte	0.0087 l/t.o.	Troy ounces of gold produced by electrolysis
Gold precipitation and filtration	4.4 l/t.o.	Troy ounces of gold precipitated
Platinum precipitation and filtration	5.2 l/t.o.	Troy ounces of platinum precipitated

TABLE IX-1 (Continued)

BPT WASTEWATER DISCHARGE RATES FOR THE SECONDARY PRECIOUS METALS SUBCATEGORY

Wastewater Stream	BAT Normalized Discharge Rates	Production Normalizing Parameter
Palladium precipitation and filtration	3.5 l/t.o.	Troy ounces of palladium precipitated
Other platinum group metals precipitation and filtration	5.2 l/t.o.	Troy ounces of other platinum group metals precipitation
Spent solution from PGC salt production	0.9 l/t.o.	Troy ounces of gold contained in PGC product
Equipment and floor wash	0.0 l/t.o.	Troy ounces of precious metals metals including silver produced in refinery

NOTES
l/t.o. = liters per troy ounce
l/l = liters per liter

TABLE IX-2

BPT MASS LIMITATIONS FOR THE SECONDARY PRECIOUS METALS SUBCATEGORY

(a) Furnace Wet Air Pollution Control BPT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/troy ounce of precious metals incinerated or smelted		
Antimony	206.100	91.900
Arsenic	150.100	66.770
Cadmium	24.410	10.770
Chromium	31.590	12.920
*Copper	136.400	71.800
*Cyanide	20.820	8.616
Lead	30.160	14.360
Nickel	137.900	91.190
Selenium	88.310	39.490
Silver	29.440	12.210
Thallium	147.200	65.340
*Zinc	104.800	43.800
*Ammonia	9,571.000	4,207.000
*Combined metals	21.540	---
*TSS	2,944.000	1,400.000
*pH	Within the range of 7.5 to 10.0 at all times	

*Regulated Pollutant

TABLE IX-2 (Continued)

BPT MASS LIMITATIONS FOR THE SECONDARY PRECIOUS METALS SUBCATEGORY

(b) Raw Material Granulation BPT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/troy ounce of precious metals in the granulated raw material		
Antimony	18.200	8.115
Arsenic	13.250	5.896
Cadmium	2.156	.951
Chromium	2.790	1.141
*Copper	12.050	6.340
*Cyanide	1.839	.761
Lead	2.663	1.268
Nickel	12.170	8.052
Selenium	7.798	3.487
Silver	2.599	1.078
Thallium	13.000	5.769
*Zinc	9.256	3.867
*Ammonia	845.100	371.500
*Combined metals	1.902	---
*TSS	259.900	123.600
*pH	Within the range of 7.5 to 10.0 at all times	

*Regulated Pollutant

TABLE IX-2 (Continued)

BPT MASS LIMITATIONS FOR THE SECONDARY PRECIOUS METALS SUBCATEGORY

(c) Spent Plating Solutions BPT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/liter of spent plating solutions used as a raw material		
Antimony	2.870	1.280
Arsenic	2.090	.930
Cadmium	.340	.150
Chromium	.440	.180
*Copper	1.900	1.000
*Cyanide	.290	.120
Lead	.420	.200
Nickel	1.920	1.270
Selenium	1.230	.550
Silver	.410	.170
Thallium	2.050	.910
*Zinc	1.460	.610
*Ammonia	133.300	58.600
*Combined metals	.300	---
*TSS	41.000	19.500
*pH	Within the range of 7.5 to 10.0 at all times	

*Regulated Pollutant

TABLE IX-2 (Continued)

BPT MASS LIMITATIONS FOR THE SECONDARY PRECIOUS METALS SUBCATEGORY

(d) Spent Cyanide Stripping Solutions BPT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
	mg/troy ounce of gold stripped	
Antimony	10.620	4.736
Arsenic	7.733	3.441
Cadmium	1.258	.555
Chromium	1.628	.666
*Copper	7.030	3.700
*Cyanide	1.073	.444
Lead	1.554	.740
Nickel	7.104	4.699
Selenium	4.551	2.035
Silver	1.517	.629
Thallium	7.585	3.367
*Zinc	5.402	2.257
*Ammonia	493.200	216.800
*Combined metals	1.110	---
*TSS	151.700	72.150
*pH	Within the range of 7.5 to 10.0 at all times	

*Regulated Pollutant

TABLE IX-2 (Continued)

BPT MASS LIMITATIONS FOR THE SECONDARY PRECIOUS METALS SUBCATEGORY

(e) Refinery Wet Air Pollution Control[1] BPT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/troy ounce of precious metals produced in refiner		
Antimony	60 270	26.880
Arsenic	43.890	19.530
Cadmium	7.140	3.150
Chromium	9.240	3.780
*Copper	39.900	21.000
*Cyanide	6.090	2.520
Lead	8.820	4.200
Nickel	40.320	26.670
Selenium	25.830	11.550
Silver	8.610	3.570
Thallium	43.050	19.110
*Zinc	30.660	12.810
*Ammonia	2,799.000	1,231.000
*Combined metals	6.300	---
*TSS	861.000	409.500
*pH	Within the range of 7.5 to 10.0 at all times	

*Regulated Pollutant

[1] This allowance applies to either acid or alkaline wet air pollution control scrubbers. If both acid and alkaline wet air pollution control scrubbers are present in a particular facility the same allowance applies to each.

TABLE IX-2 (Continued)

BPT MASS LIMITATIONS FOR THE SECONDARY PRECIOUS METALS SUBCATEGORY

(f) Gold Solvent Extraction Raffinate and Wash Water BPT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/troy ounce of gold produced by solvent extraction		
Antimony	1.808	.806
Arsenic	1.317	.586
Cadmium	.214	.095
Chromium	.277	.113
*Copper	1.197	.630
*Cyanide	.183	.076
Lead	.265	.126
Nickel	1.210	.800
Selenium	.775	.347
Silver	.258	.107
Thallium	1.292	.573
*Zinc	.920	.384
*Ammonia	83.980	36.920
*Combined metals	.189	---
*TSS	25.830	12.290
*pH Within the range of 7.5 to 10.0 at all times		

*Regulated Pollutant

TABLE IX-2 (Continued)

BPT MASS LIMITATIONS FOR THE SECONDARY PRECIOUS METALS SUBCATEGORY

(g) Gold Spent Electrolyte BPT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
	mg/troy ounce of gold produced by electrolysis	
Antimony	.025	.011
Arsenic	.018	.008
Cadmium	.003	.001
Chromium	.004	.002
*Copper	.017	.009
*Cyanide	.003	.001
Lead	.004	.002
Nickel	.017	.011
Selenium	.011	.005
Silver	.004	.001
Thallium	.018	.008
*Zinc	.013	.005
*Ammonia	1.160	.510
*Combined metals	.003	---
*TSS	.357	.170
*pH	Within the range of 7.5 to 10.0 at all times	

*Regulated Pollutant

TABLE IX-2 (Continued)

BPT MASS LIMITATIONS FOR THE SECONDARY PRECIOUS METALS SUBCATEGORY

(h) Gold Precipitation and Filtration BPT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
	mg/troy ounce of gold precipitated	
Antimony	12.630	5.632
Arsenic	9.196	4.092
Cadmium	1.496	.660
Chromium	1.936	.792
***Copper**	8.360	4.400
***Cyanide**	1.276	.528
Lead	1.848	.880
Nickel	8.448	5.588
Selenium	5.412	2.420
Silver	1.804	.748
Thallium	9.020	4.004
***Zinc**	6.424	2.684
***Ammonia**	586.500	257.800
***Combined metals**	1.320	---
***TSS**	180.400	85.800
***pH**	Within the range of 7.5 to 10.0 at all times	

***Regulated Pollutant**

TABLE IX-2 (Continued)

BPT MASS LIMITATIONS FOR THE SECONDARY PRECIOUS METALS SUBCATEGORY

(i) Platinum Precipitation and Filtration BPT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
	mg/troy ounce of platinum precipitated	
Antimony	14.920	6.656
Arsenic	10.870	4.836
Cadmium	1.768	.780
Chromium	2.288	.936
*Copper	9.880	5.200
*Cyanide	1.508	.624
Lead	2.184	1.040
Nickel	9.984	6.604
Selenium	6.396	2.860
Silver	2.132	.884
Thallium	10.660	4.732
*Zinc	7.592	3.172
*Ammonia	693.200	304.700
*Combined metals	1.560	---
*TSS	213.200	101.400
*pH	Within the range of 7.5 to 10.0 at all times	

*Regulated Pollutant

TABLE IX-2 (Continued)

BPT MASS LIMITATIONS FOR THE SECONDARY PRECIOUS METALS SUBCATEGORY

(j) Palladium Precipitation and Filtration BPT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
	mg/troy ounce of palladium precipitated	
Antimony	17.230	7.680
Arsenic	12.540	5.580
Cadmium	2.040	.900
Chromium	2.640	1.08
*Copper	11.400	6.000
*Cyanide	1.740	.720
Lead	2.520	1.200
Nickel	11.520	7.620
Selenium	7.380	3.300
Silver	2.460	1.020
Thallium	12.300	5.460
*Zinc	8.760	3.660
*Ammonia	799.800	351.600
*Combined metals	1.800	---
*TSS	246.000	117.000
*pH	Within the range of 7.5 to 10.0 at all times	

*Regulated Pollutant

TABLE IX-2 (Continued)

BPT MASS LIMITATIONS FOR THE SECONDARY PRECIOUS METALS SUBCATEGORY

(k) Other Platinum Group Metals Precipitation and Filtration BPT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/troy ounce of other platinum group metals precipitated		
Antimony	14.920	6.656
Arsenic	10.870	4.836
Cadmium	1.768	.780
Chromium	2.288	.936
*Copper	9.880	5.200
*Cyanide	1.508	.624
Lead	2.184	1.040
Nickel	9.984	6.604
Selenium	6.396	2.860
Silver	2.132	.884
Thallium	10.660	4.732
*Zinc	7.592	3.172
*Ammonia	693.200	304.700
*Combined metals	1.560	---
*TSS	213.200	101.400
*pH	Within the range of 7.5 to 10.0 at all times	

*Regulated Pollutant

TABLE IX-2 (Continued)

BPT MASS LIMITATIONS FOR THE SECONDARY PRECIOUS METALS SUBCATEGORY

(1) Spent Solution from PGC Salt Production BPT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
	mg/troy ounce of gold contained in PGC product	
Antimony	2.583	1.152
Arsenic	1.881	.837
Cadmium	.306	.135
Chromium	.396	.162
*Copper	1.710	.900
*Cyanide	.261	.108
Lead	.378	.180
Nickel	1.728	1.143
Selenium	1.107	.495
Silver	.369	.153
Thallium	1.845	.819
*Zinc	1.314	.549
*Ammonia	120.000	52.740
*Combined metals	.270	---
*TSS	36.900	17.550
*pH	Within the range of 7.5 to 10.0 at all times	

*Regulated Pollutant

TABLE IX-2 (Continued)

BPT MASS LIMITATIONS FOR THE SECONDARY PRECIOUS METALS SUBCATEGORY

(m) Equipment and Floor Wash BPT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/troy ounce of precious metals produced in refinery		
Antimony	0.000	0.000
Arsenic	0.000	0.000
Cadmium	0.000	0.000
Chromium	0.000	0.000
*Copper	0.000	0.000
*Cyanide	0.000	0.000
Lead	0.000	0.000
Nickel	0.000	0.000
Selenium	0.000	0.000
Silver	0.000	0.000
Thallium	0.000	0.000
*Zinc	0.000	0.000
*Ammonia	0.000	0.000
*Combined metals	0.000	---
*TSS	0.000	0.000
*pH	Within the range of 7.5 to 10.0 at all times	

*Regulated Pollutant

TABLE IX-2 (Continued)

BPT MASS LIMITATIONS FOR THE SECONDARY PRECIOUS METALS SUBCATEGORY

(n) Preliminary Treatment BPT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/troy ounce of total precious metals produced through this operation	
Antimony	143.500	64.000
Arsenic	104.500	46.500
Cadmium	17.000	7.500
Chromium	22.000	9.000
*Copper	95.000	50.000
*Cyanide (total)	14.500	6.000
Lead	21.000	10.000
Nickel	96.000	63.500
Selenium	61.500	27.500
Silver	20.500	8.500
Thallium	102.5	45.5
*Zinc	73.000	30.500
*Ammonia (as N)	6665.000	2930.000
*Combined metals	15.000	--
*Total suspended solids	2050.000	975.000
*pH	Within the range of 7.5 to 10.0 at all times	

*Regulated Pollutant

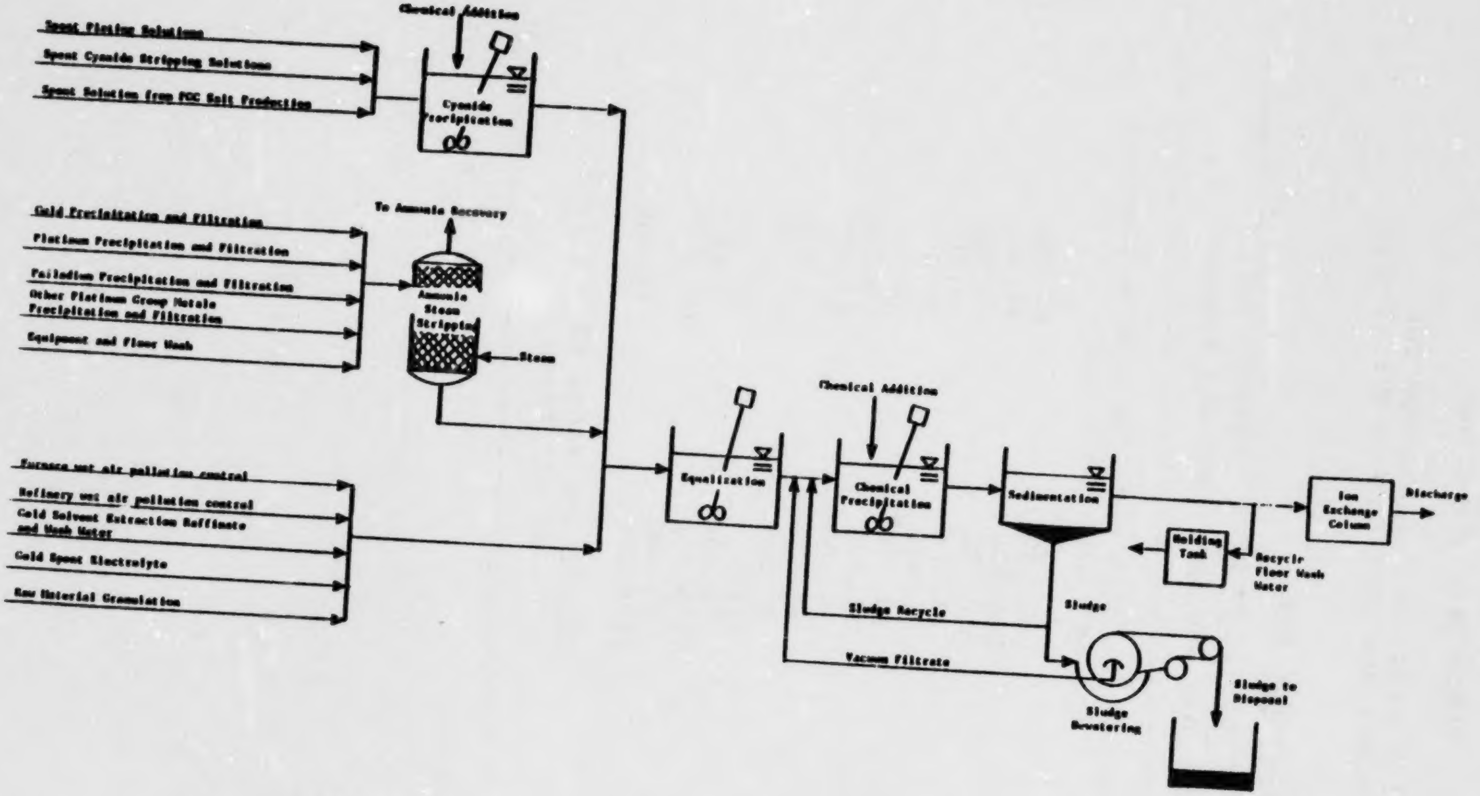
Spent Plating Solutions
Spent Cyanide Stripping Solutions
Spent Solution from PGC Salt Production
Chemical Addition
Cyanide Precipitation
Gold Precipitation and Filtration
Platinum Precipitation and Filtration
Palladium Precipitation and Filtration
Other Platinum Group Metals Precipitation and Filtration
Equipment and Floor Wash
To Ammonia Recovery
Ammonia Steam Stripping
Steam
Furnace wet air pollution control
Refinery wet air pollution control
Gold Solvent Extraction Raffinate and Wash Water
Gold Spent Electrolyte
Raw Material Granulation
Equalization
Chemical Addition
Chemical Precipitation
Sedimentation
Holding Tank
Recycle Floor Wash Water
Ion Exchange Column
Discharge
Sludge
Sludge Recycle
Vacuum Filtrate
Sludge Dewatering
Sludge to Disposal

Figure IX-1

BPT TREATMENT SCHEME FOR THE SECONDARY PRECIOUS METALS SUBCATEGORY

SECTION X

BEST AVAILABLE TECHNOLOGY ECONOMICALLY ACHIEVABLE

These effluent limitations are based on the best control and treatment technology used by a specific point source within the industrial category or subcategory, or by another category where it is readily transferable. Emphasis is placed on additional treatment techniques applied at the end of the treatment systems currently used, as well as reduction of the amount of water used and discharged, process control, and treatment technology optimization.

The factors considered in assessing best available technology economically achievable (BAT) include the age of equipment and facilities involved, the process used, process changes, nonwater quality environmental impacts (including energy requirements), and the costs of application of such technology. BAT represents the best available technology economically achievable at plants of various ages, sizes, processes, or other characteristics. Where the Agency has found the existing performance to be uniformly inadequate, BAT may be transferred from a different subcategory or category. BAT may include feasible process changes or internal controls, even when not in common practice.

The statutory assessment of BAT considers costs, but does not require a balancing of costs against pollutant removals (see Weyerhaeuser v. Costle, 11 ERC 2149 (D.C. Cir. 1978)). However, in assessing the proposed and promulgated BAT, the Agency has given substantial weight to the economic achievability of the technology.

TECHNICAL APPROACH TO BAT

The Agency reviewed a wide range of technology options and evaluated the available possibilities to ensure that the most effective and beneficial technologies were used as the basis to BAT. To accomplish this, the Agency elected to examine three technology options which could be applied to the secondary precious metals subcategory as alternatives for the basis of BAT effluent limitations.

For the development of BAT effluent limitations, mass loadings were calculated for each wastewater source or subdivision in the subcategory using the same technical approach as described in Section IX for BPT limitations development. The differences in the mass loadings for BPT and BAT are due to increased treatment effectiveness achievable with the more sophisticated BAT treatment technology and reductions in the effluent flows allocated to various waste streams.

In summary, the treatment technologies considered for the secondary precious metals subcategory are:

Option A (Figure X-1, page 2592):

- Cyanide precipitation preliminary treatment for streams containing cyanide at treatable concentrations
- Ammonia steam stripping preliminary treatment for streams containing ammonia at treatable concentrations
- Chemical precipitation and sedimentation
- Ion exchange end-of-pipe treatment

Option B (Figure X-2, page 2593) is based on

- In-process flow reduction of wet air pollution control and raw material granulation water
- Cyanide precipitation preliminary treatment for streams containing cyanide at treatable concentrations
- Ammonia steam stripping preliminary treatment for streams containing ammonia at treatable concentrations
- Chemical precipitation and sedimentation
- Ion exchange end-of-pipe treatment

Option C (Figure X-3, page 2594) is based on

- In-process flow reduction of wet air pollution control and raw material granulation water
- Cyanide precipitation preliminary treatment for streams containing cyanide at treatable concentrations
- Ammonia steam stripping preliminary treatment for streams containing ammonia at treatable concentrations
- Chemical precipitation and sedimentation
- Multimedia filtration
- Ion exchange end-of-pipe treatment

The three options examined for BAT are discussed in greater detail below. The first option considered is the same as the BPT treatment technology which was presented in the previous section.

OPTION A

Option A for the secondary precious metals subcategory is equivalent to the control and treatment technologies which were analyzed for BPT in Section IX. The BPT end-of-pipe treatment scheme includes chemical precipitation, sedimentation (caustic or lime and settle), and ion exchange, with ammonia steam stripping preliminary treatment of wastewaters containing treatable concentrations of ammonia, and cyanide precipitation preliminary treatment of wastewaters containing treatable concentrations of cyanide (see Figure X-1, page 2592). The discharge rates for Option A are equal to the discharge rates allocated to each stream as a BPT discharge flow.

OPTION B

Option B for the secondary precious metals subcategory achieves lower pollutant discharge by building upon the Option A (ammonia steam stripping, cyanide precipitation, chemical precipitation, sedimentation and ion exchange) treatment technology. Flow reduction measures are added to the Option A treatment scheme (see Figure X-2, page 2593). These flow reduction measures. including in-process changes, result in the concentration to pollutants in some wastewater streams. As explained in Section VII of the General Development Document, treatment of a more concentrated effluent allows achievement of a greater net pollutant removal and introduces the possible economic benefits associated with treating a lower volume of wastewater.

Option B flow reduction measures are reflected in the BAT wastewater discharge rates. Flow reduction has been included in determining the BAT discharge rates for furnace wet air pollution control, raw material granulation, and refinery wet air pollution control. Based on available data, the Agency did not feel that further flow reduction over BPT would be feasible for the remaining 10 waste streams in the secondary precious metals subcategory. These waste streams are:

1. Spent plating solutions,
2. Spent cyanide stripping solutions,
3. Gold solvent extraction raffinate and wash water,
4. Gold spent electrolyte,
5. Gold precipitation and filtration,
6. Platinum precipitation and filtration,
7. Palladium precipitation and filtration
8. Other platinum group metals precipitation and filtration,
9. Spent solution from PGC salt production, and
10. Equipment and floor wash.

Flow reduction measures used in Option B to reduce process wastewater generation or discharge rates include the following:

Recycle of Water Used in Wet Air Pollution Control

There are two wastewater sources associated with wet air pollution control which are regulated under these effluent limitations:

1. Furnace scrubber, and
2. Refinery scrubber.

Table X-1 (page 2592) presents the number of plants reporting wastewater from the wet air pollution control sources listed above, the number of plants practicing recycle, and the range of recycle values being listed. Recycle of both furnace scrubber water and refinery scrubber water are required for BAT. The recycle rate used for both sources is based on the average of all discharging plants which currently practice recycle of these waste streams (currently practicing greater than 90 percent recycle), as will be shown later.

Recycle of Water Used for Raw Material Granulation

As shown in Table V-2 (page 2361), three plants generate wastewater from their raw material granulation operation. One plant (1082) practices 100 percent recycle of this water, and two plants do not practice any recycle of this water. Flow reduction based on 90 percent recycle of raw material granulation water using holding tanks, is included under Option B. Recycle is demonstrated at one plant for this subdivision, and there is no reason to believe that 90 percent recycle cannot be practiced at the two other plants with this subdivision.

OPTION C

Option C for the secondary precious metals subcategory consists of all control and treatment requirements of Option B (in-process flow reduction, ammonia steam stripping, cyanide precipitation, and chemical precipitation, sedimentation and ion exchange) plus multimedia filtration technology added between the sedimentation and ion exchange operations at the end of the Option B treatment scheme (see Figure X-3 (page 2594). Multimedia filtration is used to remove suspended solids, including precipitates of priority metals, beyond the concentration attainable by gravity sedimentation. The filter suggested is of the gravity, mixed media type, although other filters, such as rapid sand filters or pressure filters, would perform satisfactorily.

INDUSTRY COST AND ENVIRONMENTAL BENEFITS

As one means of evaluating each technology option, EPA developed estimates to the pollutant removals and the compliance costs associated with each option. The methodologies are described below.

POLLUTANT REMOVAL ESTIMATES

A complete description of the methodology used to calculate the estimated pollutant removal, or benefit, achieved by the application of the various treatment options is presented in Section X of the General Development Document. The pollutant removal estimates have been revised from proposal based on comments and new data; however, the methodology for calculating pollutant removals was not changed. The data used for estimating removals are the same as those used to revise the compliance costs.

Sampling data collected during the field sampling program were used to characterize the major waste streams considered for regulation. At each sampled facility, the sampling data was production normalized for each unit operation (i.e., mass of pollutant generated per mass of product manufactured). This value, referred to as the raw waste, was used to estimate the mass of priority pollutants generated within the secondary precious metals subcategory. The pollutant removal estimates were calculated for each plant by first estimating the total mass of each pollutant in the untreated wastewater. This was calculated by first multiplying the raw waste values by the corresponding production value for that stream and then summing these values for each pollutant for every stream generated by the plant.

The volume of wastewater discharged after the application of each treatment option was estimated for each operation at each plant by comparing the actual discharge to the regulatory flow. The smaller of the two values was selected and summed with the other plant flows. The mass of pollutant discharged was then estimated by multiplying the achievable concentration values attainable with the option (mg/l) by the estimated volume of process wastewater discharged by the subcategory. The mass of pollutant removed is the difference between the estimated mass of pollutant generated within the subcategory and the mass of pollutant discharged after application of the treatment option. The pollutant removal estimates for direct dischargers in the secondary precious metals subcategory are presented in Table X-2 (page 2574).

COMPLIANCE COSTS

In estimating subcategory-wide compliance costs, the first step was to develop a cost model, relating the total costs associated with installation and operation of wastewater treatment technologies to plant process wastewater discharge. EPA applied the model on a per plant basis, a plant's costs (both capital, and operating and maintenance) being determined by what treatment it has in place and by its individual process wastewater discharge (as discussed above, this flow is either the actual or the BAT regulatory flow, whichever is lesser). The final step was to annualize the capital costs, and to sum the annualized capital costs, and the operating and maintenance costs, yielding the cost of compliance for the subcategory. These costs were used in assessing economic achievability. Table X-3 (page 2575) shows the costs developed for promulgation for direct dischargers in the secondary precious metals subcategory. Compliance costs for indirect dischargers are presented in Table XII-2 (page 2620).

BAT OPTION SELECTION - PROPOSAL

EPA selected Option C for the proposed BAT, which included ammonia steam stripping and cyanide precipitation preliminary treatment, flow reduction for furnace and refinery wet air pollution control, and chemical precipitation, sedimentation and multimedia filtration end-of-pipe treatment. Although the compliance costs for the proposed BAT are not presented because the data on which they are based has been claimed confidential, it was determined that the pollutant removals justified the costs for this subcategory. Implementation of the proposed BAT was estimated to remove 34,580 kg of priority pollutants annually.

BAT OPTION SELECTION - PROMULGATION

Following proposal, EPA received comments and collected additional data showing a need for revising two regulatory flows (raw material granulation and spent cyanide stripping solutions), to consider additional treatment for high zinc concentrations, and to include compliance costs for two facilities not included in the proposal costs. Implementation of the promulgated BAT limitations would remove annually an estimated 34,650 kg of priority pollutants, which is 14 kg of priority pollutants greater than the estimated BPT removal. No additional ammonia or cyanide is removed at BAT.

EPA has added ion exchange end-of-pipe treatment to the BAT treatment scheme discussed at proposal. Ion exchange is an effective method for removing gold, platinum and palladium from wastewaters generated in the subcategory. EPA has determined that no additional costs will be generated in this subcategory by adding ion exchange because of the value of the precious metals recovered in the column.

EPA is promulgating BAT limitations for this subcategory based on ammonia steam stripping and cyanide precipitation preliminary treatment, flow reduction for furnace and refinery wet air pollution control, as well as for raw material granulation, and chemical precipitation, sedimentation, multimedia filtration and ion exchange end-of-pipe treatment. This treatment scheme is the same as that selected at proposal with the addition of flow reduction for one stream and ion exchange end-of-pipe treatment. The treatment performance concentrations, upon which the mass limitations are based, are equal to the values used to calculate the proposed mass limitations.

EPA is promulgating multimedia filtration as part of the BAT technology because this technology results in additional removal of priority metals. Filtration is also presently demonstrated at 25 plants throughout the nonferrous metals manufacturing category, including one plant in this subcategory. Filtration adds reliability to the treatment system by making it less susceptible to operator error and to sudden changes in raw wastewater flow and concentrations.

Based on comments received after proposal, the Agency believes that it may be necessary for some facilities to use sulfide polishing in order to achieve the promulgated effluent limitations because of high zinc concentrations or complexing problems. Because the Agency believes that these situations will be the exception, rather than the rule, sulfide polishing is not specifically included as part of the model technology on which effluent limitations and performance standards are based. The Agency has, however, evaluated the cost associated with the use of sulfide polishing at secondary precious metals plants. After performing this evaluation, the Agency has concluded that sulfide polishing will result in a very small (less than 5 percent) incremental increase in wastewater treatment costs at a typical secondary precious metals facility.

BAT treatment for the secondary precious metals subcategory is shown schematically in Figure X-3 (page 2594).

Based on information made available to the Agency after promulgation, the Agency has agreed to propose to make selected amendments to the regulation promulgated on September 20, 1985, (50 FR 38276). These changes included: adding a new (omitted) building block for preliminary treatment; increasing the production normalized flow for the palladium precipitation and filtration building block, reflecting the Agency's recalculation of the average flow for the building block and the incorporation of new data; revising the manner of regulating gold, platinum, and palladium to regulate the sum of these; and, expanding the refinery wet air pollution control building block to include separate flow allowances for acid and alkaline scrubbers at facilities with both types of scrubbers.

WASTEWATER DISCHARGE RATES

A BAT discharge rate was calculated for each subdivision based upon the flows of the existing plants, as determined from analysis of the data collection portfolios. The discharge rate is used with the achievable treatment concentration to determine BAT effluent limitations. Since the discharge rate may be different for each wastewater source, separate production normalized discharge rates for each of the 14 wastewater sources were determined and are summarized in Table X-4 (page 2576). The discharge rates are normalized on a production basis by relating the amount of wastewater generated to the mass of the intermediate product which is produced by the process associated with the waste stream in question. These production normalizing parameters (PNP) are also listed in Table X-4.

As discussed previously, the promulgated BAT wastewater discharge rate equals the promulgated BPT wastewater discharge rate for 11 of the 14 waste streams in the secondary precious metals subcategory. Based on the available data, the Agency determined that further flow reduction would not be feasible for these wastewater sources. Wastewater streams for which BAT discharge rates differ from BPT are discussed below.

FURNACE WET AIR POLLUTION CONTROL

The BAT wastewater discharge rate proposed and promulgated for furnace wet air pollution control is 4.5 liters per troy ounce of precious metal, including silver, incinerated or smelted. This rate is based on the value reported by the only discharging plant practicing recycle, and it is supported by the tact that two plants achieve zero discharge through 100 percent recycle.

RAW MATERIAL GRANULATION

The BAT wastewater discharge rate promulgated for raw material granulation is 0.64 liters per troy ounce of precious metals in the granulated raw material. This rate is based on 90 percent recycle of the promulgated BPT rate of 6.34 liters per troy ounce. As discussed earlier in this section, 100 percent recycle is practiced by one plant for this subdivision, and recycle is considered feasible for the two non-recycling plants within this subdivision.

REFINERY WET AIR POLLUTION CONTROL

The BAT wastewater discharge rate proposed and promulgated for refinery wet air pollution control is 1.0 liter per troy ounce of precious metals, including silver, produced in the refinery. This rate is based on the average of all discharging plants which practice at least 90 percent recycle. These plants are shown in Table V-5 (page 2364) (1.75 liters per troy ounce, 0.19 liters per troy ounce, 0.234 liters per troy ounce, 14.2 liters per troy ounce, 0.072 liters per troy ounce, 0.67 liters per troy ounce, 0.7 liters per troy ounce, 2.3 liters per troy ounce, 0.04 liters per troy ounce, 0.174 liters per troy ounce, 0.036 liters per troy ounce, 1.665 liters per troy ounce, 1.41 liters per troy ounce, 1.1 liters per troy ounce, 0.06 liters per troy ounce, 4.64 liters per troy ounce, and 0.21 liters per troy ounce). Omitting the plant discharging 14.2 liters per troy ounce as being out to line with the water use at the majority of other dischargers, the average discharge rate equals 1.0 liter per troy ounce. This rate is supported by the average water use calculation presented in Section IX. That calculation shows average water use of 19.8 liters per troy ounce. Assuming 95 percent recycle is achievable (18 of 21 plants reported greater than 90 percent recycle for this stream), the BAT wastewater discharge rate of 1.0 liter per troy ounce is supported.

REGULATED POLLUTANT PARAMETERS

In implementing the terms of the Consent Agreement in NRDC v. Train, Op. Cit., and 33 U.S.C. $1314(b)(2)(A and B) (1976), the Agency placed particular emphasis on the priority pollutants. The raw wastewater concentrations from individual operations and the subcategory as a whole were examined to select certain pollutants and pollutant parameters for consideration for limitation. This examination and evaluation was presented in Section VI. The Agency, however, has chosen not to regulate all 12 priority pollutants selected in this analysis.

The high cost associated with analysis for priority metal pollutants has prompted EPA to develop an alternative method for regulating and monitoring priority pollutant discharges from the nonferrous metals manufacturing category. Rather than developing specific effluent mass limitations and standards for each of the priority metals found in treatable concentrations in the raw wastewaters from a given subcategory, the Agency is promulgating effluent mass limitations only for those pollutants generated in the greatest quantities as shown by the pollutant removal analysis. The pollutants selected for specific limitation are listed below:

120. copper
121. cyanide
128. zinc
ammonia (as N)
combined metals (gold, platinum, and palladium)

By establishing limitations and standards for certain priority metal pollutants, dischargers will attain the same degree of control over priority metal pollutants as they would have been required to achieve had all the priority metal pollutants been directly limited.

This approach is technically justified since the treatable concentrations used for caustic precipitation and sedimentation technology are based on optimized treatment for concomitant multiple metals removal. Thus, even though metals have somewhat different theoretical solubilities, they will be removed at very nearly the same rate in a lime precipitation and sedimentation treatment system operated for multiple metals removal. Filtration as part of the technology basis is likewise justified because this technology removes metals non-preferentially.

The priority metal pollutants selected for specific limitation in the secondary precious metals subcategory to control the discharges of priority metal pollutants are copper and zinc. Cyanide, ammonia, and combined metals (gold, platinum, and palladium), are also selected for limitation since the methods used to control copper and zinc are not effective in the control of cyanide, ammonia, and combined metals (gold, platinum, and palladium).

The following toxic pollutants are excluded from limitation on the basis that they are effectively controlled by the limitations developed for copper and zinc:

114. antimony
115. arsenic
118. cadmium
119. chromium
122. lead
124. nickel
125. selenium
126. silver
127. thallium

EFFLUENT LIMITATIONS

The treatable concentrations achievable by application of the BAT technology (Option C) are summarized in Table VII-21 (page 248) of Vol. I. These treatable concentrations (both one-day maximum and monthly average) are multiplied by the BAT normalized discharge flows summarized in Table X-4 (page 2576) to calculate the mass of pollutants allowed to be discharged per mass of product. The results of these calculations in milligrams of pollutant per troy ounce of product represent the promulgated BAT effluent limitations for the secondary precious metals subcategory. BAT effluent limitations based on Option C (ammonia steam stripping, cyanide precipitation, chemical precipitation, sedimentation, in-process flow reduction, multimedia filtration and ion exchange) are presented in Table X-5 (page 2578).

TABLE X-1

CURRENT RECYCLE PRACTICES WITHIN THE SECONDARY PRECIOUS METALS SUBCATEGORY

	Number of Plants With Wastewater	Number of Plants Practicing Recycle	Range of Recycle Values (%)
Furnace Scrubber	7	4	≥90 - 100
Raw Material Granulation	4	1	100
Refinery Scrubber	29	21	75 - 100

TABLE X-2

POLLUTANT REMOVAL ESTIMATES FOR DIRECT DISCHARGERS

Pollutant	Raw Waste (kg/yr)	Option A Discharged (kg/yr)	Option A Removed (kg/yr)	Option B Discharged (kg/yr)	Option B Removed (kg/yr)	Option C Discharged (kg/yr)	Option C Removed (kg/yr)
Antimony	1.23	0.90	0.33	0.90	0.33	0.90	0.33
Arsenic	0.40	0.30	0.10	0.30	0.11	0.30	0.11
Cadmium	3.22	0.34	2.88	0.28	2.94	0.18	3.05
Chromium (Total)	3.88	0.29	3.59	0.29	3.59	0.24	3.63
Copper	293.11	6.49	286.62	4.78	288.33	3.22	289.89
Cyanide (Total)	17.76	11.48	6.29	11.46	6.31	11.46	6.31
Lead	23.27	1.34	21.93	0.99	22.28	0.66	22.61
Mercury	0.01	0.01	0.00	0.01	0.00	0.01	0.00
Nickel	89.31	8.25	81.06	6.09	83.22	1.81	87.50
Selenium	224.90	1.86	223.04	0.97	223.93	0.65	224.25
Silver	11.23	0.49	10.74	0.36	10.87	0.25	10.98
Thallium	0.38	0.28	0.10	0.28	0.10	0.28	0.10
Zinc	34,001.15	3.69	33,937.46	2.72	33,998.43	1.89	33,999.26
Total Priority Pollutants	34,669.85	35.72	34,634.14	29.43	34,639.81	21.85	34,648.02
Ammonia	615.38	120.98	494.39	120.80	494.57	120.80	494.57
Cobalt	0.93	0.33	0.61	0.18	0.75	0.12	0.81
Fluoride	3.01	2.28	0.73	2.26	0.74	2.26	0.74
Gold	7.86	0.08	7.78	0.05	7.81	0.05	7.81
Platinum	3.58	0.08	3.50	0.05	3.53	0.05	3.53
Palladium	3.58	0.08	3.50	0.05	3.53	0.05	3.53
TOTAL NONCONVENTIONALS	634.34	123.83	510.51	123.40	510.94	123.34	511.00
TSS	18,555.34	134.29	18,421.05	98.91	18,456.43	22.30	18,533.04
Oil & Grease	8.87	6.70	2.17	6.66	2.21	6.66	2.21
TOTAL CONVENTIONALS	18,564.21	140.99	18,423.22	105.57	18,458.64	28.96	18,535.25
TOTAL POLLUTANTS	53,868.40	300.54	53,567.87	258.40	53,609.39	174.15	53,694.27

OPTION A - Chemical precipitation, sedimentation, ion exchange, ammonia steam stripping, and cyanide precipitation.

Option B - Chemical precipitation, sedimentation, ion exchange, ammonia steam stripping, cyanide precipitation, and flow reduction

Option C - Chemical precipitation, sedimentation, ion exchange, ammonia steam stripping, cyanide precipitation, flow reduction and filtration

Table X-3

COST OF COMPLIANCE FOR DIRECT DISCHARGERS IN THE SECONDARY PRECIOUS METALS SUBCATEGORY

The costs for this subcategory cannot be presented here because the data on which they are based have been claimed to be confidential.

TABLE X-4

EAT WASTEWATER DISCHARGE RATES FOR THE SECONDARY PRECIOUS METALS SUBCATEGORY

Wastewater Stream	BAT Normalized Discharge Rates	Production Normalizing Parameter
Furnace wet air pollution control	4.5 l/t.o.	Troy ounces of precious metals, including silver, incinerated or smelted
Raw material granulation	0.64 l/t.o.	Troy ounces of precious metals in the granulated raw material
Spent plating solutions	1.1 l/l	Liters of spent plating solution used as a raw material
Spent cyanide stripping solutions	3.7 l/t.o.	Troy ounces of gold stripped
Refinery wet air pollution control	1.0 l/t.o.	Troy ounces of precious metals produced in refinery, including silver
Gold solvent extraction raffinate	0.63 l/t.o.	Troy ounces of gold produced by solvent extraction
Gold spent electrolyte	0.0087 l/t.o.	Troy ounces of gold produced by electrolysis
Gold precipitation and filtration	4.4 l/t.o.	Troy ounces of gold precipitated
Platinum precipitation and filtration	5.2 l/t.o.	Troy ounces of platinum precipitated

TABLE X-4 (Continued)

BAT WASTEWATER DISCHARGE RATES FOR THE SECONDARY PRECIOUS METALS SUBCATEGORY

Wastewater Stream	BAT Normalized Discharge Rates	Production Normalizing Parameter
Palladium precipitation and filtration	3.5 l/t.o.	Troy ounces of palladium precipitated
Other platinum group metals precipitation and filtration	5.2 l/t.o.	Troy ounces of other platinum group metals precipitation
Spent solution from PGC salt production	0.9 l/t.o.	Troy ounces of gold contained in PGC product
Equipment and floor wash	0.0 l/t.o.	Troy ounces of precious metals metals including silver produced in refinery

NOTES
l/t.o. = liters per troy ounce
l/l = liters per liter

TABLE X-5

BAT MASS LIMITATIONS FOR THE SECONDARY PRECIOUS METALS SUBCATEGORY

(a) Furnace Wet Air Pollution Control BAT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/troy ounce of precious metals incinerated or smelted		
Antimony	8.685	3.870
Arsenic	6.255	2.790
Cadmium	0.900	0.360
Chromium	1.665	0.675
*Copper	5.760	2.745
*Cyanide	0.900	0.360
Lead	1.260	0.585
Nickel	2.475	1.665
Selenium	3.690	1.665
Silver	1.305	0.540
Thallium	6.300	2.745
*Zinc	4.590	1.890
*Ammonia	599.900	263.700
*Combined Metals	1.350	---

*Regulated Pollutant

TABLE X-5 (Continued)

BAT MASS LIMITATIONS FOR THE SECONDARY PRECIOUS METALS SUBCATEGORY

(b) Raw Material Granulation BAT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/troy ounce of precious metals in the granulated raw material		
Antimony	1.235	0.550
Arsenic	0.890	0.397
Cadmium	0.128	0.051
Chromium	0.237	0.096
*Copper	0.819	0.390
*Cyanide	0.128	0.051
Lead	0.179	0.083
Nickel	0.352	0.237
Selenium	0.525	0.237
Silver	0.186	0.077
Thallium	0.896	0.390
*Zinc	0.653	0.269
*Ammonia	85.310	37.500
*Combined metals	0.192	---

*Regulated Pollutant

TABLE X-5 (Continued)

BAT MASS LIMITATIONS FOR THE SECONDARY PRECIOUS METALS SUBCATEGORY

(c) Spent Plating Solutions BAT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
	mg/l of spent plating solutions used as a raw material	
Antimony	1.930	0.860
Arsenic	1.390	0.620
Cadmium	0.200	0.080
Chromium	0.370	0.150
*Copper	1.280	0.610
*Cyanide	0.200	0.080
Lead	0.280	0.130
Nickel	0.550	0.370
Selenium	0.820	0.370
Silver	0.290	0.120
Thallium	1.400	0.610
*Zinc	1.020	0.420
*Ammonia	133.300	58.600
*Combined metals	0.300	---

*Regulated Pollutant

TABLE X-5 (Continued)

BAT MASS LIMITATIONS FOR THE SECONDARY PRECIOUS METALS SUBCATEGORY

(d) Spent Cyanide Stripping Solutions BAT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
	mg/troy ounce of gold tripped	
Antimony	7.141	3.182
Arsenic	5.143	2.294
Cadmium	0.740	0.296
Chromium	1.369	0.555
*Copper	4.736	2.257
*Cyanide	0.740	0.296
Lead	1.036	0.481
Nickel	2.035	1.369
Selenium	3.034	1.369
Silver	1.073	0.444
Thallium	5.180	2.257
*Zinc	3.774	1.554
*Ammonia	493.200	216.800
*Combined metals	1.110	---

*Regulated Pollutant

TABLE X-5 (Continued)

BAT MASS LIMITATIONS FOR THE SECONDARY PRECIOUS METALS SUBCATEGORY

(e) Refinery Wet Air Pollution Control[1] BAT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/troy ounce of precious metals produced in refinery		
Antimony	1.930	0.860
Arsenic	1.390	0.620
Cadmium	0.200	0.080
Chromium	0.370	0.150
*Copper	1.280	0.610
*Cyanide	0.200	0.080
Lead	0.280	0.130
Nickel	0.550	0.370
Selenium	0.820	0.370
Silver	0.290	0.120
Thallium	1.400	0.610
*Zinc	1.020	0.420
*Ammonia	133.300	58.600
*Combined metals	0.300	---

*Regulated Pollutant

[1] This allowance applies to either acid or alkaline wet air pollution control scrubbers. If both acid and alkaline wet air pollution control scrubbers are present in a particular facility the same allowance applies to each.

TABLE X-5 (Continued)

BAT MASS LIMITATIONS FOR THE SECONDARY PRECIOUS METALS SUBCATEGORY

(f) Gold Solvent Extraction Raffinate and Wash Water BAT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/troy ounce of gold produced by solvent extraction		
Antimony	1.216	0.542
Arsenic	0.876	0.391
Cadmium	0.126	0.050
Chromium	0.233	0.095
*Copper	0.806	0.384
*Cyanide	0.126	0.050
Lead	0.176	0.082
Nickel	0.347	0.233
Selenium	0.517	0.233
Silver	0.183	0.076
Thallium	0.882	0.384
*Zinc	0.643	0.265
*Ammonia	83.980	36.920
*Combined metals	0.189	---

*Regulated Pollutant

TABLE X-5 (Continued)

BAT MASS LIMITATIONS FOR THE SECONDARY PRECIOUS METALS SUBCATEGORY

(g) Gold Spent Electrolyte BAT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
	mg/troy ounce of gold produced by electrolysis	
Antimony	0.017	0.007
Arsenic	0.012	0.005
Cadmium	0.002	0.000
Chromium	0.003	0.001
*Copper	0.011	0.005
*Cyanide	0.002	0.000
Lead	0.002	0.001
Nickel	0.005	0.003
Selenium	0.007	0.003
Silver	0.003	0.001
Thallium	0.012	0.005
*Zinc	0.009	0.004
*Ammonia	1.160	0.510
*Combined metals	0.003	---

*Regulated Pollutant

TABLE X-5 (Continued)

BAT MASS LIMITATIONS FOR THE SECONDARY PRECIOUS METALS SUBCATEGORY

(h) Gold Precipitation and Filtration BAT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
	mg/troy ounce of gold precipitated	
Antimony	8.492	3.784
Arsenic	6.116	2.728
Cadmium	0.880	0.352
Chromium	1.628	0.660
*Copper	5.632	2.684
*Cyanide	0.880	0.352
Lead	1.232	0.572
Nickel	2.420	1.628
Selenium	3.608	1.628
Silver	1.276	0.528
Thallium	6.160	2.684
*Zinc	4.488	1.848
*Ammonia	586.500	257.800
*Combined metals	1.320	---

*Regulated Pollutant

TABLE X-5 (Continued)

BAT MASS LIMITATIONS FOR THE SECONDARY PRECIOUS METALS SUBCATEGORY

(i) Platinum Precipitation and Filtration BAT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
	mg/troy ounce of platinum precipitated	
Antimony	10.040	4.472
Arsenic	7.228	3.224
Cadmium	1.040	0.416
Chromium	1.924	0.780
*Copper	6.656	3.172
*Cyanide	1.040	0.416
Lead	1.456	0.676
Nickel	2.860	1.924
Selenium	4.264	1.924
Silver	1.508	0.624
Thallium	7.280	3.172
*Zinc	5.304	2.184
*Ammonia	693.200	304.700
*Combined metals	1.560	---

*Regulated Pollutant

TABLE X-5 (Continued)

BAT MASS LIMITATIONS FOR THE SECONDARY PRECIOUS METALS SUBCATEGORY

(j) Palladium Precipitation and Filtration BAT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
	mg/troy ounce of palladium precipitated	
Antimony	11.580	5.160
Arsenic	8.340	3.720
Cadmium	1.200	0.480
Chromium	2.200	0.900
*Copper	7.680	3.660
*Cyanide	1.200	0.480
Lead	1.680	0.780
Nickel	3.300	2.220
Selenium	4.420	2.220
Silver	1.740	0.720
Thallium	8.400	3.660
*Zinc	6.120	2.520
*Ammonia	799.800	351.600
*Combined metals	1.800	---

*Regulated Pollutant

TABLE X-5 (Continued)

BAT MASS LIMITATIONS FOR THE SECONDARY PRECIOUS METALS SUBCATEGORY

(k) Other Platinum Group Metals Precipitation and Filtration BAT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/troy ounce of other platinum group metals precipitated		
Antimony	10.040	4.472
Arsenic	7.228	3.224
Cadmium	1.040	0.416
Chromium	1.924	0.780
*Copper	6.656	3.172
*Cyanide	1.040	0.416
Lead	1.456	0.676
Nickel	2.860	1.924
Selenium	4.264	1.924
Silver	1.508	0.624
Thallium	7.280	3.172
*Zinc	5.304	2.184
*Ammonia	693.200	304.700
*Combined metals	1.560	---

*Regulated Pollutant

TABLE X-5 (Continued)

BAT MASS LIMITATIONS FOR THE SECONDARY PRECIOUS METALS SUBCATEGORY

(1) Spent Solution from PGC Salt Production BAT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/troy ounce of gold contained in PGC product		
Antimony	1.737	0.774
Arsenic	1.251	0.558
Cadmium	0.180	0.072
Chromium	0.333	0.135
*Copper	1.152	0.549
*Cyanide	0.180	0.072
Lead	0.252	0.117
Nickel	0.495	0.333
Selenium	0.738	0.333
Silver	0.261	0.108
Thallium	1.260	0.549
*Zinc	0.918	0.378
*Ammonia	120.000	52.740
*Combined metals	0.270	---

*Regulated Pollutant

TABLE X-5 (Continued)

BAT MASS LIMITATIONS FOR THE SECONDARY PRECIOUS METALS SUBCATEGORY

(n) Equipment and Floor Wash BAT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/troy ounce of precious metals produced in refinery		
Antimony	0.000	0.000
Arsenic	0.000	0.000
Cadmium	0.000	0.000
Chromium	0.000	0.000
*Copper	0.000	0.000
*Cyanide	0.000	0.000
Lead	0.000	0.000
Nickel	0.000	0.000
Selenium	0.000	0.000
Silver	0.000	0.000
Thallium	0.000	0.000
*Zinc	0.000	0.000
*Ammonia	0.000	0.000
*Combined metals	0.000	---

*Regulated Pollutant

TABLE X-5 (Continued)

BAT MASS LIMITATIONS FOR THE SECONDARY PRECIOUS METALS SUBCATEGORY

(n) Preliminary Treatment BAT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/troy ounce of total precious metals produced through this operation	
Antimony	96.500	43.000
Arsenic	69.500	31.000
Cadmium	10.000	4.000
Chromium	18.500	7.500
Copper	64.000	30.500
Cyanide (total)	10.000	4.000
Lead	14.000	1.500
Nickel	27.500	18.500
Selenium	41.000	18.500
Silver	14.500	6.000
Thallium	70.000	30.500
Zinc	51.000	21.000
Combined metals	15.000	--
Ammonia (as N	6665.000	2930.000

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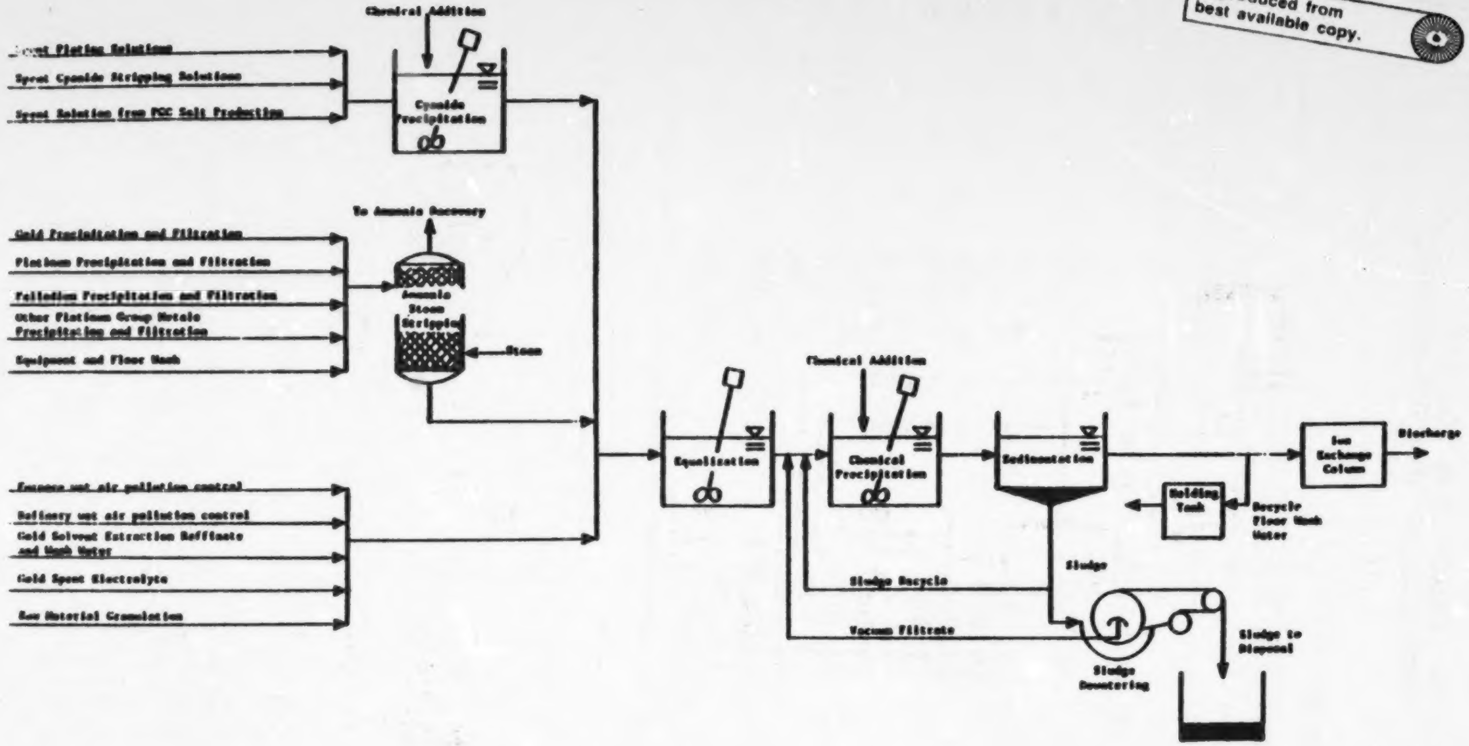
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Spent Cyanide Stripping Solutions
Spent Solution from PGC Salt Production
Chemical Addition
Cyanide Precipitation
To Ammonia Recovery
Gold Precipitation and Filtration
Platinum Precipitation and Filtration
Palladium Precipitation and Filtration
Other Platinum Group Metals Precipitation and Filtration
Equipment and Floor Wash
Ammonia Steam Stripping
Steam
Furnace wet air pollution control
Refinery wet air pollution control
Gold Solvent Extraction Raffinate and Wash Water
Gold Spent Electrolyte
Raw Material Granulation
Equalization
Chemical Addition
Chemical Precipitation
Sedimentation
Holding Tank
Recycle Floor Wash Water
Ion Exchange Column
Discharge
Sludge
Sludge Recycle
Vacuum Filtrate
Sludge Dewatering
Sludge to Disposal

Figure X-1

BAT TREATMENT SCHEME FOR OPTION A

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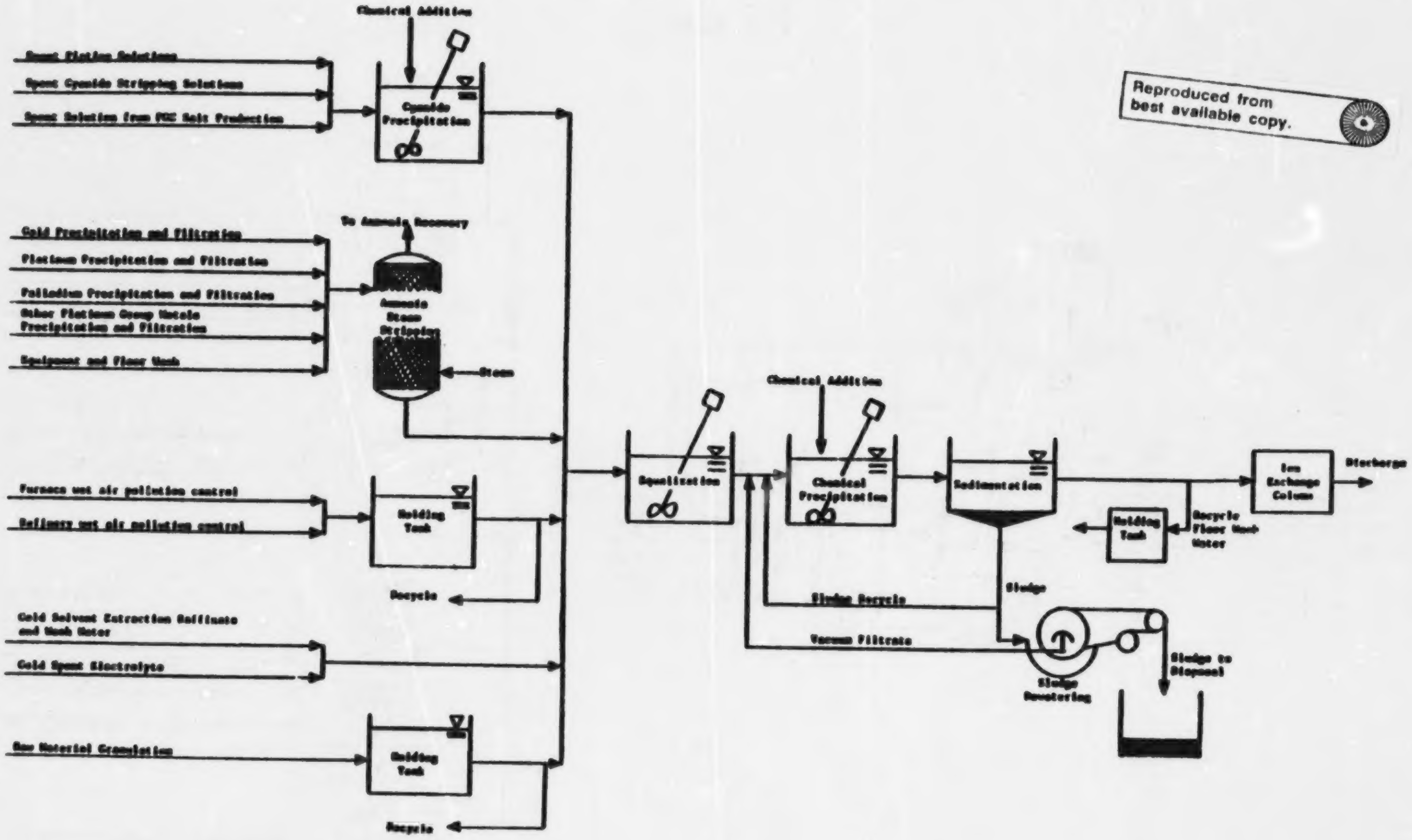
Spent Plating Solutions
Spent Cyanide Stripping Solutions
Spent Solution from PGC Salt Production
Chemical Addition
Cyanide Precipitation
Gold Precipitation and Filtration
Platinum Precipitation and Filtration
Palladium Precipitation and Filtration
Other Platinum Group Metals Precipitation and Filtration
Equipment and Floor Wash
To Ammonia Recovery
Ammonia Steam Stripping
Steam
Furnace wet air pollution control
Refinery wet air pollution control
Holding Tank
Recycle
Gold Solvent Extraction Raffinate and Wash Water
Gold Spent Electrolyte
Raw Material Granulation
Holding Tank
Recycle
Equalization
Chemical Addition
Chemical Precipitation
Sedimentation
Ion Exchange Column
Discharge
Holding Tank
Recycle Floor Wash Water
Sludge
Sludge Recycle
Vacuum Filtrate
Sludge Dewatering
Sludge to Disposal

Figure X-2

BAT TREATMENT SCHEME FOR OPTION B

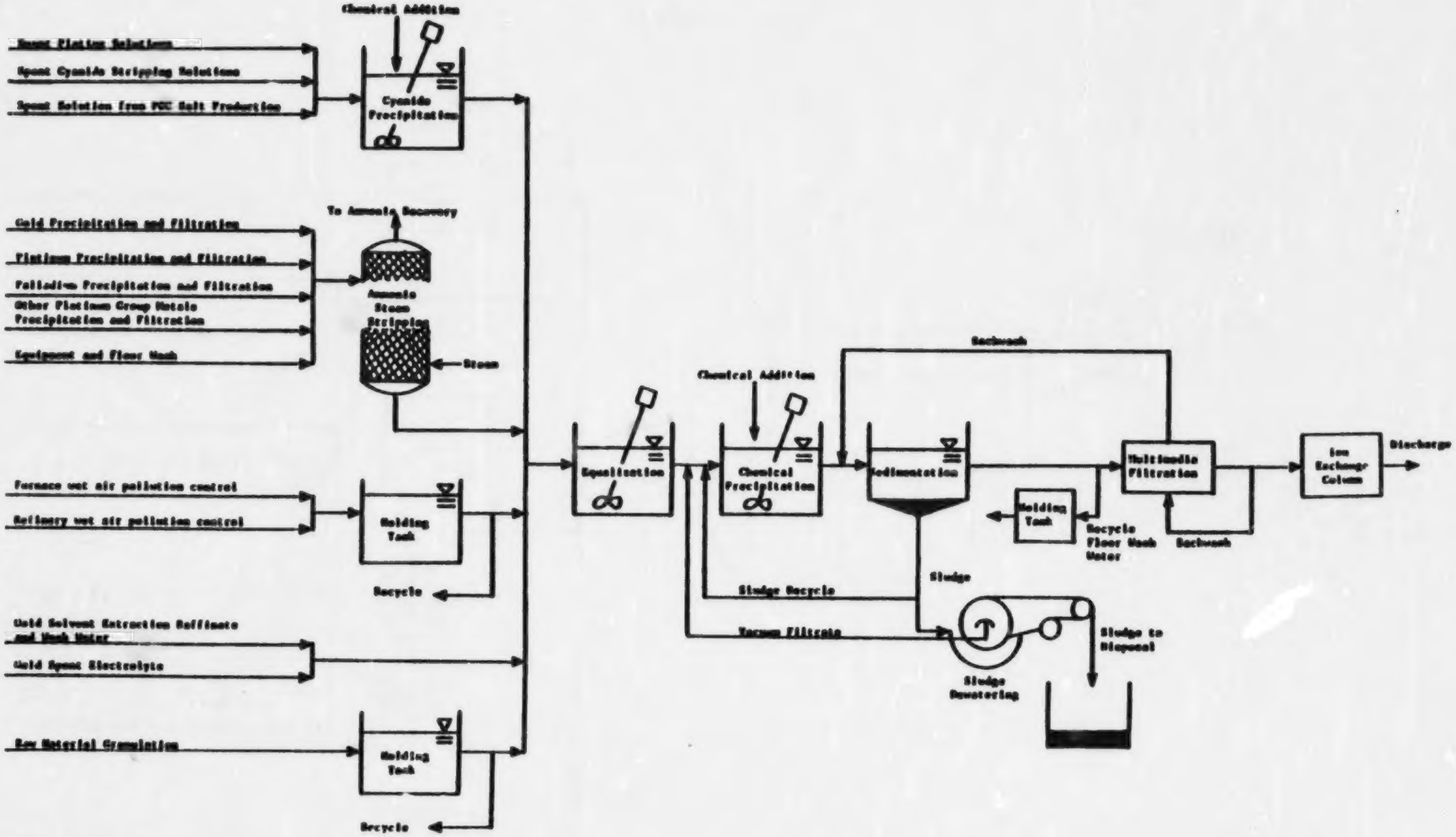
Spent Plating Solutions
Spent Cyanide Stripping Solutions
Spent Solution from PGC Salt Production
Chemical Addition
Cyanide Precipitation
Gold Precipitation and Filtration
Platinum Precipitation and Filtration
Palladium Precipitation and Filtration
Other Platinum Group Metals Precipitation and Filtration
Equipment and Floor Wash
To Ammonia Recovery
Ammonia Steam Stripping
Steam
Furnace wet air pollution control
Refinery wet air pollution control
Holding Tank
Recycle
Gold Solvent Extraction Raffinate and Wash Water
Gold Spent Electrolyte
Raw Material Granulation
Holding Tank
Recycle
Equalization
Chemical Addition
Chemical Precipitation
Backwash
Sedimentation
Holding Tank
Recycle Floor Wash Water
Multimedia Filtration
Backwash
Ion Exchange Column
Discharge
Sludge
Sludge Recycle
Vacuum Filtrate
Sludge Dewatering
Sludge to Disposal

Figure X-3

BAT TREATMENT SCHEME FOR OPTION C

SECTION XI

NEW SOURCE PERFORMANCE STANDARDS

This section describes the technologies for treatment of wastewater from new sources and presents mass discharge standards for regulated pollutants for NSPS in the secondary precious metals subcategory, based on the selected treatment technology. New plants have the opportunity to design the best and most efficient production processes and wastewater treatment technologies without facing the added costs and restrictions encountered in retrofitting an existing plant. Therefore, EPA considered the best demonstrated process changes, in-plant controls, and end-of-pipe treatment technologies which reduce pollution to the maximum extent feasible.

TECHNICAL APPROACH TO NSPS

New source performance standards are equivalent to the best available technology (BAT) selected for currently existing secondary precious metals plants. This result is a consequence of careful review by the Agency of a wide range of technical options for new source treatment systems. Additionally, there was nothing found to indicate that the wastewater flows and characteristics of new plants would not be similar to those from existing plants since the processes used by new sources are not expected to differ from those used at existing sources. BAT production normalized discharge rates, which are based on the best existing practices of the subcategory, can also be applied to new sources. These rates are presented in Table XI-1 (page 2599).

EPA proposed that furnace wet air pollution control be given a zero discharge allowance for new sources, based on dry air pollution control techniques. After reviewing comments received on the proposal, EPA has decided to revise the allowance to be equal to the allowance for furnace wet air pollution control at BAT.

Treatment technologies considered for the NSPS options are identical to the treatment technologies considered for the BAT options. These options are:

OPTION A

- o Preliminary treatment with cyanide precipitation (where required)
- o Preliminary treatment with ammonia steam stripping (where required)
- o Chemical precipitation and sedimentation
- o Ion exchange end-of-pipe treatment

OPTION B

- Preliminary treatment with cyanide precipitation (where required)
- Preliminary treatment with ammonia steam stripping (where required)
- Chemical precipitation and sedimentation
- In-process flow reduction of refinery scrubber liquor and raw material granulation water
- Ion exchange end-of-pipe treatment

OPTION C

- Preliminary treatment with cyanide precipitation (where required)
- Preliminary treatment with ammonia steam stripping (where required)
- Chemical precipitation and sedimentation
- In-process flow reduction to refinery scrubber liquor and raw material granulation water
- Multimedia filtration
- Ion exchange end-of-pipe treatment

NSPS OPTION SELECTION - PROPOSAL

EPA proposed that the best available demonstrated technology for the secondary precious metals subcategory be equivalent to the proposed Option C with additional flow reduction, which included ammonia steam stripping and cyanide precipitation preliminary treatment, dry air pollution control for furnace emissions, flow reduction for refinery wet air pollution control, and end-of-pipe treatment consisting of chemical precipitation, sedimentation, and multimedia filtration. Zero discharge for furnace air pollution control was based on dry scrubbing, which is demonstrated at 11 of 16 plants which control off-gases from the furnace. Except for furnace air pollution control, EPA proposed that NSPS wastewater discharge rates be equivalent to the proposed BAT rates. Flow reduction beyond BAT for the other 13 streams in this subcategory is not demonstrated.

NSPS OPTION SELECTION - PROMULGATION

EPA is promulgating best available demonstrated technology for the secondary precious metals subcategory equivalent to Option C which includes ammonia steam stripping and cyanide precipitation preliminary treatment, flow reduction for furnace and refinery wet air pollution control and raw material granulation, and end-of-pipe treatment consisting of chemical precipitation, sedimentation, multimedia filtration and ion exchange. As discussed under BAT option selection-promulgation, ion exchange end-of-pipe treatment is necessary to reduce gold, platinum and palladium concentrations. Regulatory flows for furnace wet air pollution control, raw material granulation and spent cyanide stripping solutions have been revised since proposal, based on comments received by the Agency on the proposed flow rates. The promulgated NSPS option is equivalent to the promulgated BAT option.

REGULATED POLLUTANT PARAMETERS

The Agency has no reason to believe that the pollutants that will be found in treatable concentrations in processes within new sources will be any different than with existing sources. Accordingly, pollutants and pollutant parameters selected for limitation under NSPS, in accordance with the rationale of Sections VI and X, are identical to those selected for BAT. The conventional pollutant parameters TSS and pH are also selected for limitation.

NEW SOURCE PERFORMANCE STANDARDS

The promulgated NSPS discharge flows for each wastewater source are the same as the promulgated discharge rates for BAT, except for furnace wet air pollution control, and are shown in Table XI-1 (page 2599). The mass of pollutant allowed to be discharged per mass of product is calculated by multiplying the appropriate treatable concentration (mg/l) by the production normalized wastewater discharge flows (liter/troy ounce). The treatable concentrations are listed in Table VII-21 (page 248) of Vol. I. The results of these calculations are the production-based new source performance standards. These standards are presented in Tables XI-2 (page 2600).

TABLE XI-1

NSPS WASTEWATER DISCHARGE RATES FOR THE SECONDARY PRECIOUS METALS SUBCATEGORY

Wastewater Stream	BAT Normalized Discharge Rates	Production Normalizing Parameter
Furnace wet air pollution control	4.5 l/t.o.	Troy ounces of precious metals, including silver, incinerated or smelted
Raw material granulation	0.64 l/t.o.	Troy ounces of precious metals in the granulated raw material
Spent plating solutions	1.1 l/l	Liters of spent plating solution used as a raw material
Spent cyanide stripping solutions	3.7 l/t.o.	Troy ounces of gold stripped
Refinery wet air pollution control	1.0 l/t.o.	Troy ounces of precious metals produced in refinery, including silver
Gold solvent extraction raffinate	0.63 l/t.o.	Troy ounces of gold produced by solvent extraction
Gold spent electrolyte	0.0087 l/t.o.	Troy ounces of gold produced by electrolysis
Gold precipitation and filtration	4.4 l/t.o.	Troy ounces of gold precipitated
Platinum precipitation and filtration	5.2 l/t.o.	Troy ounces of platinum precipitated

TABLE XI-1 (Continued)

NSPS WASTEWATER DISCHARGE RATES FOR THE SECONDARY PRECIOUS METALS SUBCATEGORY

Wastewater Stream	BAT Normalized Discharge Rates	Production Normalizing Parameter
Palladium precipitation and filtration	3.5 l/t.o.	Troy ounces of palladium precipitated
Other platinum group metals precipitation and filtration	5.2 l/t.o.	Troy ounces of other platinum group metals precipitation
Spent solution from PGC salt production	0.9 l/t.o.	Troy ounces of gold contained in PGC product
Equipment and floor wash	0.0 l/t.o.	Troy ounces of precious metals metals including silver produced in refinery

NOTES
l/t.o. = liters per troy ounce
l/l = liters per liter

TABLE XI-2

NSPS FOR THE SECONDARY PRECIOUS METALS SUBCATEGORY

(a) Furnace Wet Air Pollution Control NSPS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/troy ounce of precious metals incinerated or smelted		
Antimony	8 685	3.870
Arsenic	6.255	2.790
Cadmium	0.900	0.360
Chromium	1.665	0.675
*Copper	5.760	2.745
*Cyanide	0.900	0.360
Lead	1.260	0.585
Nickel	2.475	1.665
Selenium	3.690	1.665
Silver	1.305	0.540
Thallium	6.300	2.745
*Zinc	4.590	1.890
*Ammonia	599.900	263.700
*Combined metals	1.350	---
*TSS	67.500	54.000
*pH	Within the range of 7.5 to 10.0 at all times	

*Regulated Pollutant

TABLE XI-2 (Continued)

NSPS FOR THE SECONDARY PRECIOUS METALS SUBCATEGORY

(b) Raw Material Granulation NSPS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/troy ounce of precious metals in the granulated raw material		
Antimony	1.235	0.550
Arsenic	0.890	0.397
Cadmium	0.128	0.051
Chromium	0.237	0.096
*Copper	0.819	0.390
*Cyanide	0.128	0.051
Lead	0.179	0.083
Nickel	0.352	0.237
Selenium	0.525	0.237
Silver	0.186	0.077
Thallium	0.896	0.390
*Zinc	0.653	0.269
*Ammonia	85.310	37.500
*Combined metals	0.192	---
*TSS	9.600	7.680
*pH	Within the range of 7.5 to 10.0 at all times	

*Regulated Pollutant

TABLE XI-2 (Continued)

NSPS FOR THE SECONDARY PRECIOUS METALS SUBCATEGORY

(c) Spent Plating Solutions NSPS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/liter of spent plating solutions used as a raw material		
Antimony	1.930	0.860
Arsenic	1.390	0.620
Cadmium	0.200	0.080
Chromium	0.370	0.150
*Copper	1.280	0.610
*Cyanide	0.200	0.080
Lead	0.280	0.130
Nickel	0.550	0.370
Selenium	0.820	0.370
Silver	0.290	0.120
Thallium	1.400	0.610
*Zinc	1.020	0.420
*Ammonia	133.300	58.600
*Combined metals	0.300	---
*TSS	15.000	12.000
*pH	Within the range of 7.5 to 10.0 at all times	

*Regulated Pollutant

TABLE XI-2 (Continued)

NSPS FOR THE SECONDARY PRECIOUS METALS SUBCATEGORY

(d) Spent Cyanide Stripping Solutions NSPS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
	mg/troy ounce of gold stripped	
Antimony	7.141	3.182
Arsenic	5.143	2.294
Cadmium	0.740	0.296
Chromium	1.369	0.555
*Copper	4.736	2.257
*Cyanide	0.740	0.296
Lead	1.036	0.481
Nickel	2.035	1.369
Selenium	3.034	1.369
Silver	1.073	0.444
Thallium	5.180	2.257
*Zinc	3.774	1.554
*Ammonia	493.200	216.800
*Combined metals	1.110	---
*TSS	55.500	44.400
*pH	Within the range of 7.5 to 10.0 at all times	

*Regulated Pollutant

TABLE XI-2 (Continued)

NSPS FOR THE SECONDARY PRECIOUS METALS SUBCATEGORY

(e) Refinery Wet Air Pollution Control[1] NSPS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/troy ounce of precious metals produced in refinery		
Arsenic	1.390	0.620
Cadmium	0.200	0.080
Chromium	0.370	0.150
*Copper	1.280	0.610
*Cyanide	0.200	0.080
Lead	0.280	0.130
Nickel	0.550	0.370
Selenium	0.820	0.370
Silver	0.290	0.120
Thallium	1.400	0.610
*Zinc	1.020	0.420
*Ammonia	133.300	58.600
*Combined metals	0.300	---
*TSS	15.000	12.000
*pH	Within the range of 7.5 to 10.0 at all times	

*Regulated Pollutant

[1] This allowance applies to either acid or alkaline wet air pollution control scrubbers. If both acid and alkaline wet air pollution control scrubbers are present in a particular facility the same allowance applies to each.

TABLE XI-2 (Continued)

NSPS FOR THE SECONDARY PRECIOUS METALS SUBCATEGORY

(f) Gold Solvent Extraction Raffinate and Wash Water NSPS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/troy ounce of gold produced by solvent extraction		
Antimony	1.216	0.542
Arsenic	0.876	0.391
Cadmium	0.126	0.050
Chromium	0.233	0.095
*Copper	0.806	0.384
*Cyanide	0.126	0.050
Lead	0.176	0.082
Nickel	0.347	0.233
Selenium	0.517	0.233
Silver	0.183	0.076
Thallium	0.882	0.384
*Zinc	0.643	0.265
*Ammonia	83.980	36.920
*Combined metals	0.189	---
*TSS	9.450	7.560
*pH	Within the range of 7.5 to 10.0 at all times	

*Regulated Pollutant

TABLE XI-2 (Continued)

NSPS FOR THE SECONDARY PRECIOUS METALS SUBCATEGORY

(g) Gold Spent Electrolyte NSPS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
	mg/troy ounce of gold produced by electrolysis	
Antimony	0.017	0.007
Arsenic	0.012	0.005
Cadmium	0.002	0.000
Chromium	0.003	0.001
*Copper	0.011	0.005
*Cyanide	0.002	0.000
Lead	0.002	0.001
Nickel	0.005	0.003
Selenium	0.007	0.003
Silver	0.003	0.001
Thallium	0.012	0.005
*Zinc	0.009	0.004
*Ammonia	1.160	0.510
*Combined metals	0.003	---
*TSS	0.131	0.104
*pH	Within the range of 7.5 to 10.0 at all times	

*Regulated Pollutant

TABLE XI-2 (Continued)

NSPS FOR THE SECONDARY PRECIOUS METALS SUBCATEGORY

(h) Gold Precipitation and Filtration NSPS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
	mg/troy ounce of gold precipitated	
Antimony	8.492	3.784
Arsenic	6.116	2.728
Cadmium	0.880	0.352
Chromium	1.628	0.660
*Copper	5.632	2.684
*Cyanide	0.880	0.352
Lead	1.232	0.572
Nickel	2.420	1.628
Selenium	3.608	1.628
Silver	1.276	0.528
Thallium	6.160	2.684
*Zinc	4.488	1.848
*Ammonia	586.500	257.800
*Combined metals	1.320	---
*TSS	66.000	52.800
*pH	Within the range of 7.5 to 10.0 at all times	

*Regulated Pollutant

TABLE XI-2 (Continued)

NSPS FOR THE SECONDARY PRECIOUS METALS SUBCATEGORY

(i) Platinum Precipitation and Filtration NSPS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
	mg/troy ounce of platinum precipitated	
Antimony	10.040	4.472
Arsenic	7.228	3.224
Cadmium	1.040	0.416
Chromium	1.924	0.780
*Copper	6.656	3.172
*Cyanide	1.040	0.416
Lead	1.456	0.676
Nickel	2.860	1.924
Selenium	4.264	1.924
Silver	1.508	0.624
Thallium	7.280	3.172
*Zinc	5.304	2.184
*Ammonia	693.200	304.700
*Combined metals	1.560	---
*TSS	78.000	62.400
*pH	Within the range of 7.5 to 10.0 at all times	

*Regulated Pollutant

TABLE XI-2 (Continued)

NSPS FOR THE SECONDARY PRECIOUS METALS SUBCATEGORY

(j) Palladium Precipitation and Filtration NSPS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
	mg/troy ounce of palladium precipitated	
Antimony	11.580	5.160
Arsenic	8.340	3.720
Cadmium	1.200	0.480
Chromium	2.220	0.900
*Copper	7.680	3.660
*Cyanide	1.200	0.480
Lead	1.680	0.780
Nickel	3.300	2.220
Selenium	4.920	2.220
Silver	1.740	0.720
Thallium	8.400	3.660
*Zinc	6.120	2.520
*Ammonia	799.800	351.600
*Combined metals	1.800	---
*TSS	90.000	72.000
*pH	Within the range of 7.5 to 10.0 at all times	

*Regulated Pollutant

TABLE XI-2 (Continued)

NSPS FOR THE SECONDARY PRECIOUS METALS SUBCATEGORY

(k) Other Platinum Group Metals Precipitation and Filtration NSPS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/troy ounce of other platinum group metals precipitated		
Antimony	10.040	4.472
Arsenic	7.228	3.224
Cadmium	1.040	0.416
Chromium	1.924	0.780
Copper	6.656	3.172
*Cyanide	1.040	0.416
Lead	1.456	0.676
Nickel	2.860	1.924
Selenium	4.264	1.924
Silver	1.508	0.624
Thallium	7.280	3.172
*Zinc	5.304	2.184
*Ammonia	693.200	304.700
*Combined metals	1.560	---
*TSS	78.000	62.400
*pH	Within the range of 7.5 to 10.0 at all times	

*Regulated Pollutant

TABLE XI-2 (Continued)

NSPS FOR THE SECONDARY PRECIOUS METALS SUBCATEGORY

(1) Spent Solution from PGC Salt Production NSPS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
	mg/troy ounce of gold contained in PGC product	
Antimony	1.737	0.774
Arsenic	1.251	0.558
Cadmium	0.180	0.072
Chromium	0.333	0.135
*Copper	1.152	0.549
*Cyanide	0.180	0.072
Lead	0.252	0.117
Nickel	0.495	0.333
Selenium	0.738	0.333
Silver	0.261	0.108
Thallium	1.260	0.549
*Zinc	0.918	0.378
*Ammonia	120.000	52.740
*Combined metals	0.270	---
*TSS	13.500	10.800
*pH	Within the range of 7.5 to 10.0 at all times	

*Regulated Pollutant

TABLE XI-2 (Continued)

NSPS FOR THE SECONDARY PRECIOUS METALS SUBCATEGORY

(m) Equipment and Floor Wash NSPS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/troy ounce of precious metals produced in refinery		
Antimony	0.000	C.000
Arsenic	0.000	0.000
Cadmium	0.000	0.000
Chromium	0.000	0.000
*Copper	0.000	0.000
*Cyanide	0.000	0.000
Lead	0.000	0.000
Nickel	0.000	0.000
Selenium	0.000	0.000
Silver	0.000	0.000
Thallium	0.000	0.000
*Zinc	0.000	0.000
*Ammonia	0.000	0.000
*Combined metals	0.000	---
*TSS	0.000	0.000
*pH	Within the range of 7.5 to 10.0 at all times	

*Regulated Pollutant

TABLE XI-2 (Continued)

NSPS FOR THE SECONDARY PRECIOUS METALS SUBCATEGORY

(n) Preliminary Treatment NSPS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/troy, ounce of total precious metals produced through this operation	
Antimony	96.500	43.000
Arsenic	69.500	31.000
Cadmium	10.000	4.000
Chromium	18.500	7.500
Copper	64.000	30.500
Cyanide (total)	10.000	4.000
Lead	14.000	6.500
Nickel	27.500	18.500
Selenium	41.000	18.500
Silver	14.500	6.000
Thallium	70.000	30.500
Zinc	51.000	21.000
Combined metals	15.000	--
Ammonia (as N)	6665.000	2930.000
Total suspended solids	750.000	600.000
pH	Within the range of 7.5 to 10.0 at all times	

SECTION XII

PRETREATMENT STANDARDS

This section describes the control and treatment technologies for pretreatment of process wastewaters from existing sources and new sources in the secondary precious metals subcategory. Pretreatment standards for regulated pollutants are presented based on the selected control and treatment technology.

TECHNICAL APPROACH TO PRETREATMENT

Before proposing and promulgating pretreatment standards, the Agency examines whether the pollutants discharged by the industry pass through the POTW or interfere with the POTW operation or its chosen sludge disposal practices. In determining whether pollutants pass through a well-operated POTW achieving secondary treatment, the Agency compares the percentage of a pollutant removed by POTW with the percentage removed by direct dischargers applying the best available technology economically achievable. A pollutant is deemed to pass through the POTW when the average percentage removed nationwide by well-operated POTW meeting secondary treatment requirements, is less than the percentage removed by direct dischargers complying with BAT effluent limitations guidelines for that pollutant. (See generally, 46 FR at 9414-16 (January 28, 1981)).

This definition of pass through satisfies two competing objectives set by Congress: (1) that standards for indirect dischargers be equivalent to standards for direct dischargers while at the same time, (2) that the treatment capability and performance of the POTW be recognized and taken into account in regulating the discharge of pollutants from indirect dischargers.

The Agency compares percentage removal rather than the mass or concentration of pollutants discharged because the latter would not take into account the mass of pollutants discharged to the POTW from non-industrial sources or the dilution of the pollutants in the POTW effluent to lower concentrations due to the addition of large amounts of non-industrial wastewater.

INDUSTRY COST AND POLLUTANT REMOVAL ESTIMATES

The industry cost and pollutant removal estimates of each treatment option were used to determine the most cost-effective option. The methodology applied in calculating pollutant removal estimates and plant compliance costs is discussed in Section X. Table XII-1 (page 2619) shows the estimated pollutant removal benefits for indirect dischargers. A comparison of proposal and promulgation compliance costs for indirect dischargers are presented in Table XII-2 (page 2620).

PRETREATMENT STANDARDS FOR EXISTING AND NEW SOURCES

Options for pretreatment of wastewaters from both existing and new sources are based on increasing the effectiveness of end-of-pipe treatment technologies. All in-plant changes and applicable end-of-pipe treatment processes have been discussed previously in Sections X and XI. The options for PSES and PSNS, therefore, are the same as the BAT and NSPS options discussed in Sections X and XI, respective|y.

A description of each option is presented in Sections X and XI, while a more detailed discussion, including pollutants controlled by each treatment process is presented in Section VII of Vol. I.

Treatment technologies considered for the PSES and PSNS options are:

OPTION A

- Preliminary treatment with cyanide precipitation (where required)
- Preliminary treatment with ammonia steam stripping (where required)
- Chemical precipitation and sedimentation
- Ion exchange end-of-pipe treatment

OPTION B

- Preliminary treatment with cyanide precipitation (where required)
- Preliminary treatment with ammonia steam stripping (where required)
- Chemical precipitation and sedimentation
- In-process flow reduction of furnace and refinery scrubber liquor as well as for raw material granulation water
- Ion exchange end-of-pipe treatment

OPTION C

- Preliminary treatment with cyanide precipitation (where required)
- Preliminary treatment with ammonia steam stripping (where required)
- Chemical precipitation and sedimentation
- In-process flow reduction of furnace and refinery scrubber liquor as well as for raw material granulation water
- Multimedia filtration
- Ion exchange end-of-pipe treatment

PSES OPTION SELECTION

EPA promulgated PSES equal to BAT (Option C) for this subcategory. It is necessary to promulgate this PSES to prevent pass-through of copper, cyanide, zinc, ammonia, gold, platinum and palladium. These priority pollutants are removed by a well operated POTW achieving secondary treatment at an average of 32 percent, while BAT level technology removes approximately 99 percent.

The technology basis for PSES thus is chemical precipitation and sedimentation, ammonia steam stripping, cyanide precipitation, wastewater flow reduction, multimedia filtration and ion exchange. The achievable concentration for ammonia steam stripping is based on iron and steel manufacturing category data, as explained in the discussion of BPT and BAT for this subcategory. Flow reduction is based on the same recycle of scrubber effluent and raw material granulation water that is the flow basis of BAT. Recycle is practiced by 22 of the 31 existing plants in the subcategory.

Implementation of the promulgated PSES limitations would remove annually an estimated 110,000 kg of priority pollutants including 866 kg of cyanide, and an estimated 10,534 kg of ammonia. Capital cost for achieving promulgated PSES is $1,809,400 and annualized cost of $1,100,500. The promulgated PSES will not result in adverse economic impacts.

Based on comments received after proposal, the Agency believes that it may be necessary for some facilities to use sulfide polishing in order to achieve the promulgated effluent limitations because of high zinc concentrations or complexing problems. Because the Agency believes that these situations will be the exception, rather than the rule, sulfide polishing is not specifically included as part of the model technology on which pretreatment standards for existing sources are based. The Agency has, however, evaluated the cost associated with the use of sulfide polishing at secondary precious metals plants. After performing this evaluation, the Agency has concluded that sulfide polishing will result in a very small (less than 5 percent) incremental increase in wastewater treatment costs at a typical secondary precious metals facility.

PSNS OPTION SELECTION

We are promulgating PSNS equivalent to NSPS (Option C). The technology basis for promulgated PSNS is identical to NSPS. This is equivalent to PSES and BAT. The same pollutants pass through at PSNS as at PSES, for the same reasons. We know of no economically feasible, demonstrated technology that is better than NSPS technology. The NSPS flow allowances are based on minimization of process wastewater wherever possible through the use of holding tanks to recycle wet scrubbing wastewater and raw material granulation water. The discharges are based on recycle of these waste streams (see Section X - Recycle of Water Used in Wet Air Pollution Control).

EPA believes that the promulgated PSNS are achievable, and that they are not a barrier to entry of new plants into this subcategory.

REGULATED POLLUTANT PARAMETERS

Pollutants selected for limitation, in accordance with the rationale of Sections VI and X, are identical to those selected for limitation for BAT. It is necessary to promulgate PSES and PSNS to prevent the pass-through of copper, cyanide, zinc, ammonia, and combined metals (gold, platinum, and palladium), which are the limited pollutants.

PRETREATMENT STANDARDS

Pretreatment standards are based on the treatable concentrations from the selected treatment technology, (Option C), and the discharge rates determined in Sections X and XI for BAT and NSPS, respectively. A mass of pollutant per mass of product (mg/troy ounce) allocation is given for each subdivision within the subcategory. This pollutant allocation is based on the product of the treatable concentration from the promulgated treatment (mg/l) and the production normalized wastewater discharge rate (liter/troy ounce). The achievable treatment concentrations for BAT are identical to those for PSES and PSNS. These concentrations are listed in Table VII-21 (page 248) of Vol. I. PSES and PSNS are presented in Tables XII-4 (page 2623) and XII-5 (page 2637).

Table XII-1

POLLUTANT REMOVAL ESTIMATES FOR INDIRECT DISCHARGERS

Pollutant	Raw Waste (kg/yr)	Option A Discharge (kg/yr)	Option A Removed (kg/yr)	Option B Discharge (kg/yr)	Option B Removed (kg/yr)	Option C Discharge (kg/yr)	Option C Removed (kg/yr)
Antimony	34.87	9.85	25.01	8.15	26.72	6.31	28.56
Arsenic	12.16	5.73	6.42	4.61	7.55	3.40	8.75
Cadmium	17.02	2.96	14.06	1.13	15.88	0.70	16.31
Chromium (Total)	187.43	2.96	184.47	1.20	186.22	1.00	186.42
Copper	2,603.86	21.71	2,582.15	8.31	2,595.55	5.59	2,598.27
Cyanide (Total)	881.57	19.53	862.04	15.59	865.98	15.34	866.28
Lead	112.79	4.49	108.29	1.72	111.07	1.15	111.64
Mercury	0.10	0.09	0.00	0.09	0.01	0.09	0.01
Nickel	1,161.39	27.70	1,133.69	10.60	1,150.79	3.15	1,158.24
Selenium	2,630.50	11.12	2,619.43	4.19	2,626.36	2.79	2,627.76
Silver	42.41	3.74	38.67	1.43	40.98	1.00	41.41
Thallium	11.62	5.47	6.15	4.37	7.25	3.23	8.38
Zinc	102,677.88	12.35	102,665.53	4.73	102,673.15	3.30	102,674.59
TOTAL TOXICS	110,373.62	127.70	110,245.92	66.13	110,307.49	47.06	110,326.56
Ammonia	10,962.04	884.29	10,077.75	427.92	10,534.12	427.92	10,534.12
Cobalt	5.04	1.68	3.36	0.71	4.33	0.48	4.57
Fluoride	12.12	10.57	1.54	9.84	2.27	9.84	2.27
Gold	39.43	0.39	39.04	0.17	39.26	0.17	39.26
Platinum	17.96	0.39	17.57	0.17	17.79	0.17	17.79
Palladium	17.96	0.39	17.57	0.17	17.79	0.17	17.79
TOTAL NONCONVENTIONALS	11,054.55	896.71	10,156.84	438.99	10,615.56	438.76	10,615.79
TSS	61,714.13	449.16	61,264.96	171.94	61,542.19	37.25	61,676.87
Oil and Grease	37.66	32.87	4.78	30.51	7.15	30.51	7.15
TOTAL CONVENTIONALS	61,751.78	482.04	61,269.75	202.44	61,549.34	67.76	61,684.03
TOTAL POLLUTANTS	183,179.95	1,507.45	181,672.50	707.55	182,472.40	553.58	182,626.37

Option A - Chemical precipitation, sedimentation, ion exchange, ammonia steam stripping, and cyanide precipitation.

Option B - Chemical precipitation, sedimentation, ion exchange, ammonia steam stripping, cyanide precipitation, and flow reduction.

Option C - Chemical precipitation, sedimentation, ion exchange, ammonia steam stripping, cyanide precipitation, flow reduction, and filtration.

TABLE XII-2

COST OF COMPLIANCE FOR THE SECONDARY PRECIOUS METALS SUBCATEGORY INDIRECT DISCHARGERS

Option	Total Required Capital Cost	Total Annual Cost
A	1,774,400	1,078,000
B	1,707,000	1,034,000
C	1,809,400	1,100,500

TABLE XII-3

PSES AND PSNS WASTEWATER DISCHARGE RATES FOR THE SECONDARY PRECIOUS METALS SUBCATEGORY

Wastewater Stream	BAT Normalized Discharge Rates	Production Normalizing Parameter
Furnace wet air pollution control	4.5 l/t.o.	Troy ounces of precious metals, including silver, incinerated or smelted
Raw material granulation	0.64 l/t.o.	Troy ounces of precious metals in the granulated raw material
Spent plating solutions	1.1 l/l	Liters of spent plating solution used as a raw material
Spent cyanide stripping solutions	3.7 l/t.o.	Troy ounces of gold stripped
Refinery wet air pollution control	1.0 l/t.o.	Troy ounces of precious metals produced in refinery, including silver
Gold solvent extraction raffinate	0.63 l/t.o.	Troy ounces of gold produced by solvent extraction
Gold spent electrolyte	0.0087 l/t.o.	Troy ounces of gold produced by electrolysis
Gold precipitation and filtration	4.4 l/t.o.	Troy ounces of gold precipitated
Platinum precipitation and filtration	5.2 l/t.o.	Troy ounces of platinum precipitated

TABLE XII-3 (Continued)

PSES AND PSNS WASTEWATER DISCHARGE RATES FOR THE SECONDARY PRECIOUS METALS SUBCATEGORY

Wastewater Stream	BAT Normalized Discharge Rates	Production Normalizing Parameter
Palladium precipitation and filtration	3.5 l/t.o.	Troy ounces of palladium precipitated
Other platinum group metals precipitation and filtration	5.2 l/t.o.	Troy ounces of other platinum group metals precipitation
Spent solution from PGC salt production	0.9 l/t.o.	Troy ounces of gold contained in PGC product
Equipment and floor wash	0.0 l/t.o.	Troy ounces of precious metals metals including silver produced in refinery

NOTES
l/t.o. = liters per troy ounce
l/l = liters per liter

TABLE XII-4

PSES FOR THE SECONDARY PRECIOUS METALS SUBCATEGORY

(a) Furnace Wet Air Pollution Control PSES

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/troy ounce of precious metals incinerated or smelted		
Antimony	8.685	3.870
Arsenic	6.255	2.790
Cadmium	0.900	0.360
Chromium	1.665	0.675
*Copper	5.760	2.745
*Cyanide	0.900	0.360
Lead	1.260	0.585
Nickel	2.475	1.665
Selenium	3.690	1.665
Silver	1.305	0.540
Thallium	6.300	2.745
*Zinc	4.590	1.890
*Ammonia	599.900	263.700
*Combined metals	1.350	---

*Regulated Pollutant

TABLE XII-4 (Continued)

PSES FOR THE SECONDARY PRECIOUS METALS SUBCATEGORY

(b) Raw Material Granulation PSES

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/troy ounce of precious metal in the granulated raw material		
Antimony	1.235	0.550
Arsenic	0.890	0.397
Cadmium	0.128	0.051
Chromium	0.237	0.096
*Copper	0.819	0.390
*Cyanide	0.128	0.051
Lead	0.179	0.083
Nickel	0.352	0.237
Selenium	0.525	0.237
Silver	0.186	0.077
Thallium	0.896	0.390
*Zinc	0.653	0.269
*Ammonia	85.310	37.500
*Combined metals	0.192	---

*Regulated Pollutant

TABLE XII-4 (Continued)

PSES FOR THE SECONDARY PRECIOUS METALS SUBCATEGORY

(c) Spent Plating Solutions PSES

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/liter of spent plating solutions used as a raw material		
Antimony	1.930	0.860
Arsenic	1.390	0.620
Cadmium	0.200	0.080
Chromium	0.370	0.150
*Copper	1.280	0.610
*Cyanide	0.200	0.080
Lead	0.280	0.130
Nickel	0.550	0.370
Selenium	0.820	0.370
Silver	0.290	0.120
Thallium	1.400	0.610
*Zinc	1.020	0.420
*Ammonia	133.300	58.600
*Combined metals	0.300	---

*Regulated Pollutant

TABLE XII-4 (Continued)

PSES FOR THE SECONDARY PRECIOUS METALS SUBCATEGORY

(d) Spent Cyanide Stripping Solutions PSES

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
	mg/troy ounce of gold stripped	
Antimony	7.141	3.182
Arsenic	5.143	2.294
Cadmium	0.740	0.296
Chromium	1.369	0.555
*Copper	4.736	2.257
*Cyanide	0.740	0.296
Lead	1.036	0.481
Nickel	2.035	1.369
Selenium	3.034	1.369
Silver	1.073	0.444
Thallium	5.180	2.257
*Zinc	3.774	1.554
*Ammonia	493.200	216.800
*Combined metals	1.110	---

*Regulated Pollutant

TABLE XII-4 (Continued)

PSES FOR THE SECONDARY PRECIOUS METALS SUBCATEGORY

(e) Refinery Wet Air Pollution Control[1] PSES

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/troy ounce of precious metals produced in refinery		
Antimony	1.930	0.860
Arsenic	1.390	0.620
Cadmium	0.200	0.080
Chromium	0.370	0.150
*Copper	1.280	0.610
*Cyanide	0.200	0.080
Lead	0.280	0.130
Nickel	0.550	0.370
Selenium	0.820	0.370
Silver	0.290	0.120
Thallium	1.400	0.610
*Zinc	1.020	0.420
*Ammonia	133.300	58.600
*Combined metals	0.300	---

*Regulated Pollutant

[1] This allowance applies to either acid or alkaline wet air pollution control scrubbers. If both acid and alkaline wet air pollution control scrubbers are present in a particular facility the same allowance applies to each.

TABLE XII-4 (Continued)

PSES FOR THE SECONDARY PRECIOUS METALS SUBCATEGORY

(f) Gold Solvent Extraction Raffinate and Wash Water NSPS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/troy ounce of gold produced by solvent extraction		
Antimony	1.216	0.542
Arsenic	0.876	0.391
Cadmium	0.126	0.050
Chromium	0.233	0.095
*Copper	0.806	0.384
*Cyanide	0.126	0.050
Lead	0.176	0.082
Nickel	0.347	0.233
Selenium	0.517	0.233
Silver	0.183	0.076
Thallium	0.882	0.384
*Zinc	0.643	0.265
*Ammonia	83.980	36.920
*Combined metals	0.189	---

*Regulated Pollutant

TABLE XII-4 (Continued)

PSES FOR THE SECONDARY PRECIOUS METALS SUBCATEGORY

(g) Gold Spent Electrolyte PSES

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/troy ounce of gold produced by electrolysis		
Antimony	0.017	0.007
Arsenic	0.012	0.005
Cadmium	0.002	0.000
Chromium	0.003	0.001
*Copper	0.011	0.005
*Cyanide	0.002	0.000
Lead	0.002	0.001
Nickel	0.005	0.003
Selenium	0.007	0.003
Silver	0.003	0.001
Thallium	0.012	0.005
*Zinc	0.009	0.004
*Ammonia	1.160	0.510
*Combined metals	0.003	---

*Regulated Pollutant

TABLE XII-4 (Continued)

PSES FOR THE SECONDARY PRECIOUS METALS SUBCATEGORY

(h) Gold Precipitation and Filtration PSES

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
	mg/troy ounce of gold precipitated	
Antimony	8.492	3.784
Arsenic	6.116	2.728
Cadmium	0.880	0.352
Chromium	1.628	0.660
*Copper	5.632	2.684
*Cyanide	0.880	0.352
Lead	1.232	0.572
Nickel	2.420	1.628
Selenium	3.608	1.628
Silver	1.276	0.528
Thallium	6.160	2.684
*Zinc	4.488	1.848
*Ammonia	586.500	257.800
*Combined metals	1.320	---

*Regulated Pollutant

TABLE XII-4 (Continued)

PSES FOR THE SECONDARY PRECIOUS METALS SUBCATEGORY

(i) Platinum Precipitation and Filtration PSES

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
	mg/troy ounce of platinum precipitated	
Antimony	10.040	4.472
Arsenic	7.228	3.224
Cadmium	1.040	0.416
Chromium	1.924	0.780
*Copper	6.656	3.172
*Cyanide	1.040	0.416
Lead	1.456	0.676
Nickel	2.860	1.924
Selenium	4.264	1.924
Silver	1.508	0.624
Thallium	7.280	3.172
*Zinc	5.304	2.184
*Ammonia	693.200	304.700
*Combined metals	1.560	---

*Regulated Pollutant

TABLE XII-4 (Continued)

PSES FOR THE SECONDARY PRECIOUS METALS SUBCATEGORY

(j) Palladium Precipitation and Filtration PSES

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
	mg/troy ounce of palladium precipitated	
Antimony	11.580	5.160
Arsenic	8.340	3.720
Cadmium	1.200	0.480
Chromium	2.200	0.900
*Copper	7.680	3.660
*Cyanide	1.200	0.480
Lead	1.680	0.780
Nickel	3.300	2.220
Selenium	4.920	2.220
Silver	1.740	0.720
Thallium	8.400	3.660
*Zinc	6.120	2.520
*Ammonia	799.800	351.600
*Combined metals	1.800	---

*Regulated Pollutant

TABLE XII-4 (Continued)

PSES FOR THE SECONDARY PRECIOUS METALS SUBCATEGORY

(k) Other Platinum Group Metals Precipitation and Filtration PSES

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/troy ounce of other platinum group metals precipitated		
Antimony	10.040	4.472
Arsenic	7.228	3.224
Cadmium	1.040	0.416
Chromium	1.924	0.780
*Copper	6.656	3.172
*Cyanide	1.040	0.416
Lead	1.456	0.676
Nickel	2.860	1.924
Selenium	4.264	1.924
Silver	1.508	0.624
Thallium	7.280	3.172
*Zinc	5.304	2.184
*Ammonia	693.200	304.700
*Combined metals	1.560	---

*Regulated Pollutant

TABLE XII-4 (Continued)

PSES FOR THE SECONDARY PRECIOUS METALS SUBCATEGORY

(1) Solution from PGC Salt Production PSES

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/troy ounce of gold contained in PGC product		
Antimony	1.737	0.774
Arsenic	1.251	0.558
Cadmium	0.180	0.072
Chromium	0.333	0.135
*Copper	1.152	0.549
*Cyanide	0.180	0.072
Lead	0.252	0.117
Nickel	0.495	0.333
Selenium	0.738	0.333
Silver	0.261	0.108
Thallium	1.260	0.549
*Zinc	0.918	0.378
*Ammonia	120.000	52.740
*Combined metals	0.270	---

*Regulated Pollutant

TABLE XII-4 (Continued)

PSES FOR THE SECONDARY PRECIOUS METALS SUBCATEGORY

(m) Equipment and Floor Wash PSES

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
	mg/troy ounce of precious metals produced in refinery	
Antimony	0.000	0.000
Arsenic	0.000	0.000
Cadmium	0.000	0.000
Chromium	0.000	0.000
*Copper	0.000	0.000
*Cyanide	0.000	0.000
Lead	0.000	0.000
Nickel	0.000	0.000
Selenium	0.000	0.000
Silver	0.000	0.000
Thallium	0.000	0.000
*Zinc	0.000	0.000
*Ammonia	0.000	0.000
*Combined metals	0.000	---

*Regulated Pollutant

TABLE XII-4 (Continued)

PSES FOR THE SECONDARY PRECIOUS METALS SUBCATEGORY

(n) Preliminary Treatment PSES

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of total precious metals produced through this operation		
Antimony	96.500	43.000
Arsenic	69.500	31.000
Cadmium	10.000	4.000
Chromium	18.500	7.500
Copper	64.000	30.500
Cyanide (total)	10.000	4.000
Lead	14.000	6.500
Nickel	27.500	18.500
Selenium	41.000	18.500
Silver	14.500	6.000
Thallium	70.000	30.500
Zinc	51.000	21.000
Combined metals	15.000	--
Ammonia (as N)	6665.000	2930.000

TABLE XII-5

PSNS FOR THE SECONDARY PRECIOUS METALS SUBCATEGORY

(a) Furnace Wet Air Pollution Control PSNS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
	mg/troy ounce of precious metals incinerated or smelted	
Antimony	8.685	3.870
Arsenic	6.255	2.790
Cadmium	0.900	0.360
Chromium	1.665	0.675
*Copper	5.760	2.745
*Cyanide	0.900	0.360
Lead	1.260	0.585
Nickel	2.475	1.665
Selenium	3.690	1.665
Silver	1.305	0.540
Thallium	6.300	2.745
*Zinc	4.590	1.890
*Ammonia	599.900	263.700
*Combined metals	1.350	---

*Regulated Pollutant

TABLE XII-5 (Continued)

PSNS FOR THE SECONDARY PRECIOUS METALS SUBCATEGORY

(b) Raw Material Granulation PSNS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/troy ounce of precious metals in the granulated raw material		
Antimony	1.235	0.550
Arsenic	0.890	0.397
Cadmium	0.128	0.051
Chromium	0.237	0.096
*Copper	0.819	0.390
*Cyanide	0.128	0.051
Lead	0.179	0.083
Nickel	0.352	0.237
Selenium	0.525	0.237
Silver	0.186	0.077
Thallium	0.896	0.390
*Zinc	0.653	0.269
*Ammonia	85.310	37.500
*Combined metals	0.192	---

*Regulated Pollutant

TABLE XII-5 (Continued)

PSNS FOR THE SECONDARY PRECIOUS METALS SUBCATEGORY

(c) Spent Plating Solutions PSNS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/liter of spent plating solutions used as a raw material		
Antimony	1.930	0.860
Arsenic	1.390	0.620
Cadmium	0.200	0.080
Chromium	0.370	0.150
*Copper	1.280	0.610
*Cyanide	0.200	0.080
Lead	0.280	0.130
Nickel	0.550	0.370
Selenium	0.820	0.370
Silver	0.290	0.120
Thallium	1.400	0.610
*Zinc	1.020	0.420
*Ammonia	133.300	58.600
*Combined metals	0.300	---

*Regulated Pollutant

TABLE XII-5 (Continued)

PSNS FOR THE SECONDARY PRECIOUS METALS SUBCATEGORY

(d) Spent Cyanide Stripping Solutions PSNS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/troy ounce of gold stripped		
Antimony	7.141	3.182
Arsenic	5.143	2.294
Cadmium	0.740	0.296
Chromium	1.369	0.555
*Copper	4.736	2.257
*Cyanide	0.740	0.296
Lead	1.036	0.481
Nickel	2.035	1.369
Selenium	3.034	1.369
Silver	1.073	0.444
Thallium	5.180	2.257
*Zinc	3.774	1.554
*Ammonia	493.200	216.800
*Combined metals	1.110	---

*Regulated Pollutant

TABLE XII-5 (Continued)

PSNS FOR THE SECONDARY PRECIOUS METALS SUBCATEGORY

(e) Refinery Wet Air Pollution Control[1] PSNS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
	mg/troy ounce of precious metals produced in refinery	
Antimony	1.930	0.860
Arsenic	1.390	0.620
Cadmium	0.200	0.080
Chromium	0.370	0.150
*Copper	1.280	0.610
*Cyanide	0.200	0.080
Lead	0.280	0.130
Nickel	0.550	0.370
Selenium	0.820	0.370
Silver	0.290	0.120
Thallium	1.400	0.610
*Zinc	1.020	0.420
*Ammonia	133.300	58.600
*Combined metals	0.300	---

*Regulated Pollutant

[1] This allowance applies to either acid or alkaline wet air pollution control scrubbers. If both acid and alkaline wet air pollution control scrubbers are present in a particular facility the same allowance applies to each.

TABLE XII-5 (Continued)

PSNS FOR THE SECONDARY PRECIOUS METALS SUBCATEGORY

(f) Gold Solvent Extraction Raffinate and Wash Water PSNS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/troy ounce of gold produced by solvent extraction		
Antimony	1.216	0.542
Arsenic	0.876	0.391
Cadmium	0.126	0.050
Chromium	0.233	0.095
*Copper	0.806	0.384
*Cyanide	0.126	0.050
Lead	0.176	0.082
Nickel	0.347	0.233
Selenium	0.517	0.233
Silver	0.183	0.076
Thallium	0.882	0.384
*Zinc	0.643	0.265
*Ammonia	83.980	36.920
*Combined metals	0.189	---

*Regulated Pollutant

TABLE XII-5 (Continued)

PSNS FOR THE SECONDARY PRECIOUS METALS SUBCATEGORY

(g) Gold Spent Electrolyte PSNS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/troy ounce of gold produced by electrolysis		
Antimony	0.017	0.007
Arsenic	0.012	0.005
Cadmium	0.002	0.000
Chromium	0.003	0.001
*Copper	0.011	0.005
*Cyanide	0.002	0.000
Lead	0.002	0.001
Nickel	0.005	0.003
Selenium	0.007	0.003
Silver	0.003	0.001
Thallium	0.012	0.005
*Zinc	0.009	0.004
*Ammonia	1.160	0.510
*Combined metals	0.003	---

*Regulated Pollutant

TABLE XII-5 (Continued)

PSNS FOR THE SECONDARY PRECIOUS METALS SUBCATEGORY

(h) Gold Precipitation and Filtration PSNS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
	mg/troy ounce of gold precipitated	
Antimony	8.492	3.784
Arsenic	6.116	2.728
Cadmium	0.880	0.352
Chromium	1.628	0.660
*Copper	5.632	2.684
*Cyanide	0.880	0.352
Lead	1.232	0.572
Nickel	2.420	1.628
Selenium	3.608	1.628
Silver	1.276	0.528
Thallium	6.160	2.684
*Zinc	4.488	1.848
*Ammonia	586.500	257.800
*Combined metals	1.320	---

*Regulated Pollutant

TABLE XII-5 (Continued)

PSNS FOR THE SECONDARY PRECIOUS METALS SUBCATEGORY

(i) Platinum Precipitation and Filtration PSNS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
	mg/troy ounce of platinum precipitated	
Antimony	10.040	4.472
Arsenic	7.228	3.224
Cadmium	1.040	0.416
Chromium	1.924	0.780
*Copper	6.656	3.172
*Cyanide	1.040	0.416
Lead	1.456	0.676
Nickel	2.860	1.924
Selenium	4.264	1.924
Silver	1.508	0.624
Thallium	7.280	3.172
*Zinc	5.304	2.184
*Ammonia	693.200	304.700
*Combined metals	1.560	---

*Regulated Pollutant

TABLE XII-5 (Continued)

PSNS FOR THE SECONDARY PRECIOUS METALS SUBCATEGORY

(j) Palladium Precipitation and Filtration PSNS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
	mg/troy ounce of palladium precipitated	
Antimony	11.580	5.160
Arsenic	8.340	3.720
Cadmium	1.200	0.480
Chromium	2.200	0.900
*Copper	7.680	3.660
*Cyanide	1.200	0.480
Lead	1.680	0.780
Nickel	3.300	2.220
Selenium	4.920	2.220
Silver	1.740	0.720
Thallium	8.400	3.660
*Zinc	6.120	2.520
*Ammonia	799.800	351.600
*Combined metals	1.800	---

*Regulated Pollutant

TABLE XII-5 (Continued)

PSNS FOR THE SECONDARY PRECIOUS METALS SUBCATEGORY

(k) Other Platinum Group Metals Precipitation and Filtration PSNS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/troy ounce of other platinum group metals precipitated		
Antimony	10.040	4.472
Arsenic	7.228	3.224
Cadmium	1.040	0.416
Chromium	1.924	0.780
*Copper	6.656	3.172
*Cyanide	1.040	0.416
Lead	1.456	0.676
Nickel	2.860	1.924
Selenium	4.264	1.924
Silver	1.508	0.624
Thallium	7.280	3.172
*Zinc	5.304	2.184
*Ammonia	693.200	304.700
*Combined metals	1.560	---

*Regulated Pollutant

TABLE XII-5 (Continued)

PSNS FOR THE SECONDARY PRECIOUS METALS SUBCATEGORY

(1) Spent Solution from PGC Salt Production PSNS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
	mg/troy ounce of gold contained in PGC product	
Antimony	1.737	0.774
Arsenic	1.251	0.558
Cadmium	0.180	0.072
Chromium	0.333	0.135
*Copper	1.152	0.549
*Cyanide	0.180	0.072
Lead	0.252	0.117
Nickel	0.495	0.333
Selenium	0.738	0.333
Silver	0.261	0.108
Thallium	1.260	0.549
*Zinc	0.918	0.378
*Ammonia	120.000	52.740
*Combined metals	0.270	---

*Regulated Pollutant

TABLE XII-5 (Continued)

PSNS FOR THE SECONDARY PRECIOUS METALS SUBCATEGORY

(m) Equipment and Floor Wash PSNS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
	mg/troy ounce of precious metals produced in refinery	
Antimony	0.000	0.000
Arsenic	0.000	0.000
Cadmium	0.000	0.000
Chromium	0.000	0.000
*Copper	0.000	0.000
*Cyanide	0.000	0.000
Lead	0.000	0.000
Nickel	0.000	0.000
Selenium	0.000	0.000
Silver	0.000	0.000
Thallium	0.000	0.000
*Zinc	0.000	0.000
*Ammonia	0.000	0.000
*Combined metals	0.000	---

*Regulated Pollutant

TABLE XII-5 (Continued)

PSNS FOR THE SECONDARY PRECIOUS METALS SUBCATEGORY

(n) Preliminary Treatment PSNS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/troy ounce of total precious metals produced through this operation	
Antimony	96.500	43.000
Arsenic	69.500	31.000
Cadmium	10.000	4.000
Chromium	18.500	7.500
Copper	64.000	30.500
Cyanide (total)	10.000	4.000
Lead	14.000	6.500
Nickel	27.500	18.500
Selenium	41.000	18.500
Silver	14.500	6.000
Thallium	70.000	30.500
Zinc	51.000	21.000
Combined metals	15.000	--
Ammonia (as N)	6665.000	2930.000

SECONDARY PRECIOUS METALS SUBCATEGORY

SECTION XIII

BEST CONVENTIONAL POLLUTANT CONTROL TECHNOLOGY

EPA is not promulgating best conventional pollutant control technology (BCT) for the secondary precious metals subcategory at this time.

NONFERROUS METALS MANUFACTURING POINT SOURCE CATEGORY

DEVELOPMENT DOCUMENT SUPPLEMENT

for the

Secondary Silver Subcategory

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May 1989

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SECONDARY SILVER SUBCATEGORY

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SECTION I

SUMMARY

This document provides the technical basis for promulgating effluent limitations based on best practicable technology (BPT) and best available technology economically achievable (BAT) for existing direct dischargers, pretreatment standards for existing indirect dischargers (PSES), pretreatment standards for new indirect dischargers (PSNS), and standards of performance for new source direct dischargers (NSPS) for plants in the Secondary Silver Subcategory.

The secondary silver subcategory is comprised of 61 plants. Of the 61 plants, seven discharge directly to rivers, lakes, or streams; 26 discharge to publicly owned treatment works (POTW); and 28 achieve zero discharge of process wastewater.

EPA first studied the secondary silver subcategory to determine whether differences in raw materials, final products, manufacturing processes, equipment, age and size of plants, or water usage, required the development of separate effluent limitations and standards for different segments of the subcategory. This involved a detailed analysis of wastewater discharge and treated effluent characteristics, including the sources and volume of water used, the processes used, the sources of pollutants and wastewaters in the plant, and the toxic and other pollutant constituents of wastewater.

As a result 11 subdivisions or building blocks have been identified in this subcategory that warrant separate effluent limitations. These include:

1. Film stripping
2. Film stripping wet air pollution control and precipitation and filtration of film stripping solutions wet air pollution control,
3. Precipitation and filtration of film stripping solutions,
4. Precipitation and filtration of photographic solutions,
5. Precipitation and filtration of photographic solutions wet air pollution control,
6. Electrolytic refining,
7. Furnace wet air pollution control,
8. Leaching,
9. Leaching wet air pollution control and precipitation of nonphotographic solutions wet air pollution control,
10. Precipitation and filtration of nonphotographic solutions, and
11. Floor and equipment washdown.

Several distinct control and treatment technologies (both in-plant and end-of-pipe) applicable to the secondary silver subcategory were identified. The Agency analyzed both historical and newly generated data on the performance of these technologies, including their nonwater quality environmental impacts (such as air quality impacts and solid waste generation), and energy requirements. EPA also studied various flow reduction techniques reported in the data collection portfolios (dcp) and plant visits.

Engineering costs were prepared for each of the control and treatment options considered for the category. These costs were then used by the Agency to estimate the impact of implementing the various options on the subcategory. For each control and treatment option that the Agency found to be most effective and technically feasible in controlling the discharge of pollutants, the number of potential closures, number of employees affected, and impact on price were estimated. These results are reported in a separate document entitled "The Economic Impact Analysis of Effluent Limitations and Standards for the Nonferrous Metals Manufacturing Industry."

Based on consideration of the above factors, EPA identified various control and treatment technologies which formed the basis for BPT and selected control and treatment appropriate for each set of standards and limitations. The mass limitations and standards for BPT, BAT, NSPS, PSES, and PSNS are presented in Section II.

After examining the various treatment technologies, the Agency has identified BPT to represent the average of the best existing technology. Metals removal based on lime precipitation and sedimentation technology is the basis for the BPT limitations. Steam stripping was selected as the technology basis for ammonia limitations. Complete recycle of treated flow and equipment washdown water is also included. To meet the BPT effluent limitations, the secondary silver subcategory will incur an estimated capital cost of $0.110 million (1982 dollars) and an annual cost of $0.309 million (1982 dollars).

For BAT, the Agency has built upon the BPT basis of lime precipitation and sedimentation by adding in-process control technology and multimedia filtration. In-process control technology includes recycle or reuse of process water from wet air pollution control. Filtration is added as a polishing step to further reduce metals and suspended solids concentrations. To meet BAT effluent limitations based on this technology, the secondary silver subcategory is estimated to incur a capital cost of $0.278 million (1982 dollars) and an annual cost of $0.390 million (1982 dollars).

The best demonstrated technology, BDT, which is the technical basis of NSPS, is equivalent to BAT. In selecting BDT, EPA recognizes that new plants have the opportunity to implement the best and most efficient manufacturing processes and treatment technology. However, the technology basis of BAT has been determined as the best demonstrated technology because no additional process modifications or treatment technologies have been identified that substantially improve BAT performance.

Pretreatment standards for existing sources are based on the same technology as BAT. The technology basis is in-process flow reduction, ammonia steam stripping preliminary treatment, lime precipitation, sedimentation, complete recycle of treated floor and equipment washdown water, and multimedia filtration. To meet PSES, the secondary silver subcategory is estimated to incur a capital cost of $0.634 million (1982 dollars) and an annual cost of $0.422 million (1982 dollars).

For pretreatment standards for new sources (PSNS), the Agency selected preliminary treatment, end-of-pipe treatment, and in-process flow reduction control techniques equivalent to BDT. As such, the PSNS are identical to the NSPS for all wastewater streams.

SECTION II

CONCLUSIONS

EPA has divided the secondary silver subcategory into 11 subdivisions or building blocks for the purpose of effluent limitations and standards. These subdivisions are:

(a) Film stripping,
(b) Film stripping wet air pollution control and precipitation and filtration of film stripping solutions wet air pollution control,
(c) Precipitation and filtration of film stripping solutions,
(d) Precipitation and filtration of photographic solutions,
(e) Precipitation and filtration of photographic solutions wet air pollution control,
(f) Electrolytic refining,
(g) Furnace wet air pollution control,
(h) Leaching,
(i) Leaching wet air pollution control and precipitation of nonphotographic solutions wet air pollution control,
(j) Precipitation and filtration of nonphotographic solutions, and
(k) Floor and equipment washdown.

Promulgated BPT is based on the performance achievable by the application of chemical precipitation and sedimentation (lime and settle) technology, along with preliminary treatment consisting of ammonia steam stripping for selected waste streams. Complete recycle of treated floor and equipment washdown is also included. The following BPT effluent limitations are promulgated for existing sources:

(a) Film Stripping BPT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver from film stripping		
Copper	95.670	50.350
Zinc	73.510	30.720
Ammonia (as N)	6,712.000	2,951.000
Total Suspended Solids	2,065.000	981.800
pH	Within the range of 7.0 to 10.0 at all times	

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(b) Film Stripping Wet Air Pollution Control and Precipitation and Filtration of Film Stripping Solutions Wet Air Pollution Control BPT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver from precipitation and filtration of film stripping solutions		
Copper	1.843	0.970
Zinc	1.416	0.592
Ammonia (as N)	129.300	56.840
Total Suspended Solids	39.770	18.920
pH	Within the range of 7.0 to 10.0 at all times	

(c) Precipitation and Filtration of Film Stripping Solutions BPT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver precipitated		
Copper	109.400	57.570
Zinc	84.050	35.120
Ammonia (as N)	7,674.000	3,374.000
Total Suspended Solids	2,361.000	1,123.000
pH	Within the range of 7.0 to 10.0 at all times	

(d) Precipitation and Filtration of Photographic Solutions BPT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver precipitated		
Copper	50.540	26.600
Zinc	38.836	16.226
Ammonia (as N)	3,545.000	1,559.000
Total Suspended Solids	1,090.600	518.700
pH	Within the range of 7.0 to 10.0 at all times	

(e) Precipitation and Filtration of Photographic Solutions Wet Air Pollution Control BPT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver from precipitation and filtration of photographic solutions		
Copper	23.070	12.140
Zinc	17.730	7.406
Ammonia (as N)	1,618.000	711.400
Total Suspended Solids	497.800	236.800
pH	Within the range of 7.0 to 10.0 at all times	

(f) Electrolytic Refining BPT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver from electrolytic refining		
Copper	1.444	0.760
Zinc	1.110	0.464
Ammonia (as N)	101.300	44.540
Total Suspended Solids	31.160	14.820
pH	Within the range of 7.0 to 10.0 at all times	

(g) Furnace Wet Air Pollution Control BPT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver roasted, smelted or dried		
Copper	1.273	0.670
Zinc	0.978	0.409
Ammonia (as N)	89.310	39.260
Total Suspended Solids	27.470	13.070
pH	Within the range of 7.0 to 10.0 at all times	

(h) Leaching BPT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver produced from leaching		
Copper	0.164	0.086
Zinc	0.126	0.053
Ammonia (as N)	11.470	5.040
Total Suspended Solids	3.526	1.677
pH	Within the range of 7.0 to 10.0 at all times	

(i) Leaching Wet Air Pollution Control and Precipitation of Nonphotographic Solutions Wet Air Pollution Control BPT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver produced from leaching or silver precipitated		
Copper	8.417	4.430
Zinc	6.468	2.703
Ammonia (as N)	590.500	259.600
Total Suspended Solids	181.700	86.390
pH	Within the range of 7.0 to 10.0 at all times	

(j) Precipitation and Filtration of Nonphotographic Solutions BPT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver precipitated		
Copper	5.833	3.070
Zinc	4.482	1.873
Ammonia (as N)	409.300	179.900
Total Suspended Solids	125.900	59.870
pH	Within the range of 7.0 to 10.0 at all times	

(k) Floor and Equipment Washdown BPT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver production		
Copper	0.000	0.000
Zinc	0.000	0.000
Ammonia (as N)	0.000	0.000
Total Suspended Solids	0.000	0.000
pH	Within the range of 7.0 to 10.0 at all times	

EPA is promulgating BAT based on the performance achievable by the application of in-process flow reduction, chemical precipitation, sedimentation, complete recycle of treated floor and facility washdown water, and multimedia filtration, along with ammonia steam stripping for selected wastewater streams. The following BAT effluent limitations are promulgated for existing sources:

(a) Film Stripping BAT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver from film stripping		
Copper	64.450	30.720
Zinc	51.360	21.150
Ammonia(as N)	6,712.000	2,951.000

(b) Film Stripping Wet Air Pollution Control and Precipitation and Filtration of Film Stripping Solutions Wet Air Pollution Control BAT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver from precipitation and filtration of film stripping solutions		
Copper	1.242	0.592
Zinc	0.990	0.408
Ammonia (as N)	129.300	56.840

(c) Precipitation and Filtration of Film Stripping Solutions BAT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver precipitated		
Copper	73.690	35.120
Zinc	58.720	24.180
Ammonia (as N)	7,674.000	3,374.000

(d) Precipitation and Filtration of Photographic Solutions BAT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver precipitated		
Copper	34.048	16.226
Zinc	27.132	11.172
Ammonia (as N)	3,545.000	1,559.000

(e) Precipitation and Filtration of Photographic Solutions Wet Air Pollution Control BAT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver from precipitation and filtration of photographic solutions		
Copper	15.540	7.406
Zinc	12.380	5.099
Ammonia (as N)	1,618.000	711.400

(f) Electrolytic Refining BAT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver from electrolytic refining		
Copper	0.973	0.464
Zinc	0.775	0.319
Ammonia (as N)	101.300	44.540

(g) Furnace Wet Air Pollution Control BAT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver roasted, smelted, or dried		
Copper	0.000	0.000
Zinc	0.000	0.000
Ammonia (as N)	0.000	0.000

(h) Leaching BAT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver produced from leaching		
Copper	0.110	0.053
Zinc	0.088	0.036
Ammonia (as N)	11.470	5.040

(i) Leaching Wet Air Pollution Control and Precipitation of Nonphotographic Solutions Wet Air Pollution Control BAT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver produced from leaching or silver precipitated		
Copper	5.671	2.703
Zinc	4.519	1.861
Ammonia (as N)	590.500	259.600

(j) Precipitation and Filtration of Nonphotographic Solutions BAT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver precipitated		
Copper	3.930	1.873
Zinc	3.132	1.290
Ammonia (as N)	409.300	179.900

(k) Floor and Equipment Washdown BAT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver production		
Copper	0.000	0.000
Zinc	0.000	0.000
Ammonia (as N)	0.000	0.000

NSPS are promulgated based on the performance achievable by the application of chemical precipitation, sedimentation, and multimedia filtration (lime, settle, and filter) technology and in-process flow reduction control methods, along with complete recycle of treated floor and equipment washdown water and preliminary treatment consisting of ammonia steam stripping for selected waste streams. The following effluent standards are promulgated for new sources:

(a) Film Stripping NSPS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver from film stripping		
Copper	64.450	30.720
Zinc	51.360	21.150
Ammonia(as N)	6,712.000	2,951.000
Total Suspended Solids	755.300	604.200
pH	Within the range of 7.0 to 10.0 at all times	

(b) Film Stripping Wet Air Pollution Control and Precipitation and Filtration of Film Stripping Solutions Wet Air Pollution Control NSPS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver from precipitation and filtration of film stripping solutions		
Copper	1.242	0.592
Zinc	0.990	0.408
Ammonia (as N)	129.300	56.840
Total Suspended Solids	14.550	11.640
pH	Within the range of 7.0 to 10.0 at all times	

(c) Precipitation and Filtration of Film Stripping Solutions NSPS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver precipitated		
Copper	73.690	35.120
Zinc	58.720	24.180
Ammonia (as N)	7,674.000	3,374.000
Total Suspended Solids	863.600	690.900
pH	Within the range of 7.0 to 10.0 at all times	

(d) Precipitation and Filtration of Photographic Solutions NSPS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver precipitated		
Copper	34.048	16.226
Zinc	27.132	11.172
Ammonia (as N)	3,545.000	1,559.000
Total Suspended Solids	399.000	319.200
pH	Within the range of 7.0 to 10.0 at all times	

(e) Precipitation and Filtration of Photographic Solutions Wet Air Pollution Control NSPS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver from precipitation and filtration of photographic solutions		
Copper	15.540	7.406
Zinc	12.380	5.099
Ammonia (as N)	1,618.000	711.400
Total Suspended Solids	182.100	145.700
pH	Within the range of 7.0 to 10.0 at all times	

(f) Electrolytic Refining NSPS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver from electrolytic refining		
Copper	0.973	0.464
Zinc	0.775	0.319
Ammonia (as N)	101.300	44.540
Total Suspended Solids	11.400	9.120
pH	Within the range of 7.0 to 10.0 at all times	

(g) Furnace Wet Air Pollution Control NSPS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver roasted, smelted, or dried		
Copper	0	0
Zinc	0	0
Ammonia (as N)	0	0
Total Suspended Solids	0	0
pH	Within the range of 7.0 to 10.0 at all times	

(h) Leaching NSPS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver produced from leaching		
Copper	0.110	0.053
Zinc	0.088	0.036
Ammonia (as N)	11.470	5.040
Total Suspended Solids	1.290	1.032
pH	Within the range of 7.0 to 10.0 at all times	

(i) Leaching Wet Air Pollution Control and Precipitation of Nonphotographic Solutions Wet Air Pollution Control NSPS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver produced from leaching or silver precipitated		
Copper	5.671	2.703
Zinc	4.519	1.861
Ammonia (as N)	590.500	259.600
Total Suspended Solids	66.450	53.160
pH	Within the range of 7.0 to 10.0 at all times	

(j) Precipitation and Filtration of Nonphotographic Solutions NSPS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver precipitated		
Copper	3.930	1.873
Zinc	3.132	1.290
Ammonia (as N)	409.300	179.900
Total Suspended Solids	46.050	36.840
pH	Within the range of 7.0 to 10.0 at all times	

(k) Floor and Equipment Washdown NSPS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver production		
Copper	0.000	0.000
Zinc	0.000	0.000
Ammonia (as N)	0.000	0.000
Total Suspended Solids	0.000	0.000
pH	Within the range of 7.0 to 10.0 at all times	

EPA is promulgating PSES based on the performance achievable by the application of in-process flow reduction, chemical precipitation, sedimentation, complete recycle of treated floor and facility washdown water, and multimedia filtration, along with ammonia steam stripping for selected waste streams. The following pretreatment standards are promulgated for existing sources:

(a) Film Stripping PSES

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver from film stripping		
Copper	64.450	30.720
Zinc	51.360	21.150
Ammonia(as N)	6,712.000	2,951.000

(b) Film Stripping Wet Air Pollution Control and Precipitation and Filtration of Film Stripping Solutions Wet Air Pollution Control PSES

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver from precipitation and filtration of film stripping solutions		
Copper	1.242	0.592
Zinc	0.990	0.408
Ammonia (as N)	129.300	56.840

(c) Precipitation and Filtration of Film Stripping Solutions PSES

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/troy ounce of silver precipitated	
Copper	73.690	35.120
Zinc	58.720	24.180
Ammonia (as N)	7,674.000	3,374.000

(d) Precipitation and Filtration of Photographic Solutions PSES

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/troy ounce of silver precipitated	
Copper	34.048	16.226
Zinc	27.132	11.172
Ammonia (as N)	3,545.000	1,559.000

(e) Precipitation and Filtration of Photographic Solutions Wet Air Pollution Control PSES

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/troy ounce of silver from precipitation and filtration of photographic solutions	
Copper	15.540	7.406
Zinc	12.380	5.099
Ammonia (as N)	1,618.000	711.400

(f) Electrolytic Refining PSES

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver from electrolytic refining		
Copper	0.973	0.464
Zinc	0.775	0.319
Ammonia (as N)	101.300	44.540

(g) Furnace Wet Air Pollution Control PSES

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver roasted, smelted, or dried		
Copper	0	0
Zinc	0	0
Ammonia (as N)	0	0

(h) Leaching PSES

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver produced from leaching		
Copper	0.110	0.053
Zinc	0.088	0.036
Ammonia (as N)	11.470	5.040

(i) Leaching Wet Air Pollution Control and Precipitation of Nonphotographic Solutions Wet Air Pollution Control PSES

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver produced from leaching or silver precipitated		
Copper	5.671	2.703
Zinc	4.519	1.861
Ammonia (as N)	590.500	259.600

(j) Precipitation and Filtration of Nonphotographic Solutions PSES

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver precipitated		
Copper	3.930	1.873
Zinc	3.132	1.290
Ammonia (as N)	409.300	179.900

(k) Floor and Equipment Washdown PSES

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver production		
Copper	0.000	0.000
Zinc	0.000	0.000
Ammonia (as N)	0.000	0.000

PSNS are promulgated based on the performance achievable by the application of chemical precipitation, sedimentation, and multimedia filtration (lime, settle, and filter) technology and in-process flow reduction control methods, along with complete recycle of treated floor and equipment washdown water and preliminary treatment consisting of ammonia steam stripping for selected waste streams. The following pretreatment standards are promulgated for new sources:

(a) Film Stripping PSNS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver from film stripping		
Copper	64.450	30.720
Zinc	51.360	21.150
Ammonia(as N)	6,712.000	2,951.000

(b) Film Stripping Wet Air Pollution Control and Precipitation and Filtration of Film Stripping Solutions Wet Air Pollution Control PSNS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver from precipitation and filtration of film stripping solutions		
Copper	1.242	0.592
Zinc	0.990	0.408
Ammonia (as N)	129.300	56.840

(c) Precipitation and Filtration of Film Stripping Solutions PSNS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver precipitated		
Copper	73.690	35.120
Zinc	58.720	24.180
Ammonia (as N)	7,674.000	3,374.000

(d) Precipitation and Filtration of Photographic Solutions PSNS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver precipitated		
Copper	34.048	16.226
Zinc	27.132	11.172
Ammonia (as N)	3,545.000	1,559.000

(e) Precipitation and Filtration of Photographic Solutions Wet Air Pollution Control PSNS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver from precipitation and filtration of photographic solutions		
Copper	15.540	7.406
Zinc	12.380	5.099
Ammonia (as N)	1,618.000	711.400

(f) Electrolytic Refining PSNS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver from electrolytic refining		
Copper	0.973	0.464
Zinc	0.775	0.319
Ammonia (as N)	101.300	44.540

(g) Furnace Wet Air Pollution Control PSNS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver roasted, smelted, or dried		
Copper	0.000	0.000
Zinc	0.000	0.000
Ammonia (as N)	0.000	0.000

(h) Leaching PSNS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver produced from leaching		
Copper	0.110	0.053
Zinc	0.088	0.036
Ammonia (as N)	11.470	5.040

(i) Leaching Wet Air Pollution Control and Precipitation of Nonphotographic Solutions Wet Air Pollution Control PSNS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver produced from leaching or silver precipitated		
Copper	5.671	2.703
Zinc	4.519	1.861
Ammonia (as N)	590.500	259.600

(j) Precipitation and Filtration of Nonphotographic Solutions PSNS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver precipitated		
Copper	3.930	1.873
Zinc	3.132	1.290
Ammonia (as N)	409.300	179.900

(k) Floor and Equipment Washdown PSNS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver production		
Copper	0.000	0.000
Zinc	0.000	0.000
Ammonia (as N)	0.000	0.000

SECTION III

SUBCATEGORY PROFILE

This section of the secondary silver supplement describes the raw materials and processes used in refining secondary silver and presents a profile of the secondary silver plants identified in this study.

The production of secondary silver can be divided into two processing types based on the source of raw materials: photographic and nonphotographic. Photographic processes for recovering silver include film stripping and precipitation, film incineration, chemical precipitation from solution, metallic replacement in solution, and direct electrolytic refining. Nonphotographic manufacturing involves precipitation of silver from waste plating solutions, melting and casting of sterling silver scrap, and processing electrical component scrap.

RAW MATERIALS

The principal raw materials used by plants recovering silver from photographic materials are discarded photographic film (both color and black and white), scrap photographic papers, and silver-rich sludges and solutions from photographic processing. Waste plating solutions, sterling ware scrap, and electrical component scrap are the principal raw materials used in the nonphotographic category.

PHOTOGRAPHIC MATERIALS

Photographic raw materials silver recovery can be divided into two primary sources, discarded film and photographic papers, and film processing solutions. There are many different processes for recovering silver from photographic materials. The most common methods are discussed below.

The silver in the emulsion on discarded film can be recovered by stripping and precipitation, or incineration. Figure III-1 (page 2697) represents a general flow diagram of photographic film scrap processes. The primary steps are:

1. Granulation,
2. Stripping,
3. Sedimentation and filtration,
4. Precipitation,
5. Roasting,
6. Casting,
7. Purification, and
8. Melting and casting.

Photographic film can be stripped directly or first shredded and granulated. Dust generated by granulation is collected with a baghouse and recycled to the precipitation step further along in the process. The film can be stripped of the silver-bearing emulsion in a number of ways. In one method, the film is stripped using nitric acid, resulting in a silver nitrate solution. The reaction of emulsion with nitric acid produces nitrogen-containing air emissions (NO_x), which are removed with a scrubber, resulting in a wastewater stream. Another method uses wet oxidation with a catalyst at high temperature and pressure to produce a silver liquor. A third stripping process converts silver in the film to silver chloride using ferric chloride solution containing hydrochloric acid.

A silver-rich solution is usually separated from the granulated film base (residue) by sedimentation, decantation, and filtration. The residue is discarded as solid waste, usually in a landfill. Some plants salvage the film base with washing, dewatering, and drying steps. The film base can be reused as a raw material for new photographic film. Wastewater can be generated during the washing of the film base.

Silver in solution can be precipitated by various precipitating agents. Caustic soda, soda ash (Na_2CO_3), and proteolytic enzymes are commonly used. Alum is used as a flocculating agent in some processes. The addition of chloride ion will precipitate silver chloride which can be reduced to silver by direct hydrogen reduction with gaseous hydrogen under high temperature and pressure. Thiosulfate solution also converts silver chloride to a soluble silver complex, silver thiosulfate, from which the silver may be electrodeposited. Recovered baghouse dust from the granulation step may also be added during the precipitation step.

The silver-free supernatant is decanted and is a source of wastewater. Silver sludge is dewatered by gravity or filter thickening, vacuum filtration, centrifuging, or drying. The water removed is sent to waste treatment. Alkaline or acidic fumes emitted from the precipitation step are scrubbed, resulting in a wastewater stream. Silver sludge filtration and washing produces another silver-free wastewater stream.

The dried cake is roasted in a reverberatory furnace. The impure silver is then cast into ingots or dore plates. The furnace slag is crushed and classified, and the silver concentrate recycled as furnace feed, while the tailings are landfilled. Most processes have baghouses for control of particulates in furnace off-gases. Some use scrubbers and electrostatic precipitators. Contact cooling water is used at some plants during casting. Other plants air cool the ingots on dore plates.

Dore plates are electrolytically refined on-site or shipped to other facilities. The electrolytic purification is carried out in either Balbach-Thum cells (horizontal electrodes) or Moebius cells (vertical electrodes). A current is passed between an anode and a cathode which are suspended in solution. Silver collects on the cathode. A typical electrolyte solution consists of silver nitrate and a small amount of nitric acid. The electrolyte is kept slightly to mildly acidic, a pH range of approximately 2 to 6. The refined silver is periodically scraped from the cathode and washed to remove residual electrolyte. In addition to refined silver, electrolysis produces a waste stream of spent electrolyte and wash water, and a slime containing precious metals such as gold and platinum. The slime may be further refined for precious metals recovery.

The refined silver is dried, melted in a melting furnace, and cast as ingots. Pollution control of furnace off-gases is handled with a baghouse, scrubber, or electrostatic precipitator. Contact cooling water is used in the casting steps, as well as casting scrubbers which produce wastewater streams.

Photographic film and photographic papers may be incinerated, rather than processed by granulation, stripping, and precipitation. The temperature and rate of burning must be carefully controlled if high efficiency is to be maintained. Air emissions include organic vapors from the volatilization and decomposition of organic scrap contaminants, as well as combustion gases and dust. The emissions are sometimes controlled by afterburners; at some plants, afterburners are used in series with a baghouse or scrubber. Wet scrubbing techniques produce a wastewater discharge. Silver-bearing ash is then fed directly to roasting and the impure silver is cast and electrolytically refined as described above. Some refineries buy silver-bearing ash from scrap dealers.

There are three basic methods for recovering silver from photographic processing solutions: chemical precipitation, metallic replacement, and direct electrolytic refining. Silver recovery from baths has also been successful by adsorption from solution by ion exchange. Reverse osmosis has been used on dilute solutions.

Silver-rich solutions from photographic film developing and manufacturing undergo precipitation and purification as described above. One alternate method uses sulfide compounds, particularly sodium sulfide as the precipitating agent. Gaseous emissions, such as hydrogen sulfide, are controlled with a wet scrubber, resulting in a wastewater stream. The subsequent process for silver recovery is identical to other precipitation methods.

Silver ions can be effectively reduced from solution to a solid state by a replacement reaction. Any metal more active than silver will go into solution as an ion, while the silver ion becomes solid metal. Zinc, aluminum, copper, and iron are commonly used to recover silver by replacement from photographic fixing solutions. The silver sludge produced can be filtered, roasted, and cast as described previously.

Although used as a purification step in other recovery processes, electrolytic refining is also a direct means of silver recovery. In the electrolytic method, a current is passed between an anode and a cathode which are suspended in a solution which contains greater than 1.0 mg/l of silver. Solutions containing silver below this concentration are difficult to refine electrolytically. Silver, about 99 percent pure, collects on the cathode. The cathode is periodically stripped to recover the silver. If the current density is too high for the amount of silver in the solution, thiosulfate in solution will decompose, forming silver sulfide. This reduces current efficiency and will render the regenerated solution unsuitable for reuse. Spent electrolyte solution is discarded or further refined for other precious metals. If the thiosulfate in solution is allowed to decompose, gaseous sulfur emissions (SO_x), must be controlled with a scrubber. Wastewater may also be generated from washing the silver scraped off the cathode.

NONPHOTOGRAPHIC MATERIALS

Based on the source of raw materials, the nonphotographic materials category can be divided into three basic processes for the recovery of silver: precipitation of waste plating solutions, melting of silverware, dental scrap, coins, and sterling-silver industry scrap (e.g., turnings, sweeps), and refining of electrical components scrap.

Silver-plated tableware is produced by electroplating silver from cyanide solutions onto preformed shapes made of tin, iron, zinc, or copper. Silver wastes generated are spills of silver-rich electrolyte, dilute wash solutions, and spent electrolyte. Cyanide plating solutions are treated to precipitate the silver and oxidize the cyanide. As shown in Figure III-2 (page 2698), the process consists of precipitation, filtration and washing, drying or roasting, casting, refining, and recasting. Some processors cast the silver before refining and sell the ingots to other refiners.

Precipitation is usually accomplished by addition of sodium hypochlorite, resulting in silver chloride. After settling, the silver chloride is washed, filtered, and dried to be sold as product or further processed with methods similar to those used for photographic silver precipitates. The cyanide left in solution may be oxidized with sodium hypochlorite and lime and discarded as wastewater. Wastewater streams also result from waste washing water and the filtrate and dewatering wastes. Wet scrubbers are used to control fumes from the precipitation and filtration steps. Roasting and melting furnaces also require air pollution control to remove particulates. Baghouses are usually used.

An alternate silver recovery method is precipitation of silver as the metal, using zinc metal with sodium chloride solution. The subsequent steps are identical to other precipitation processes.

The solid waste products from the sterling silver industry include defective tableware, trimmings, turnings, punchings, fumes, spillage, drosses from melting and casting, and dusts. The different wastes vary in impurity and the relatively pure materials are melted, assayed, and reused. Lower quality wastes are combined, melted and cast, and the bullions are electrolytically refined as described above.

Silver scrap from electrical components includes electrical contacts, wire, silver-bearing batteries, condensers and solders. Figure III-3 (page 2699) shows typical production processes followed if electrical scrap is not suitable for electrolytic refining. Silver is recovered from electrical component scrap using one of three methods.

In the first method, the base metals are leached from the silver residue after smelting. After careful sorting and sampling, the scrap is smelted in a reverberatory furnace to produce lead bullion, copper matte, and slag. The slag is smelted in a blast furnace to separate the lead and copper portions, which are recycled. Blast furnace slag is discarded. Dust and fumes from both the reverberatory and blast furnaces are collected and recycled. The lead bullion from the reverberatory smelting furnace and lead from the blast furnace is fed to a reverberatory-type cupola furnace. The cupellation produces litharge and precious metal layers. The litharge is sent to a lead refinery or reduced for recycle to the reverberatory smelting unit. The cupola furnace requires a baghouse or scrubber to remove emission gas pollutants. The precious metal layer is cast into anodes (dore plates) for electrolytic refining. The silver collects on the cathodes, which are melted and cast as refined ingots. The slime residue, containing gold and platinum, is further refined. The spent electrolyte solution may be discarded as waste. Wastewater streams are also generated if contact cooling water is used in casting, and if melting furnace and casting scrubbers, which remove particulates emitted from these operations, are used. The copper matte from the initial smelting is crushed, ground, roasted, and leached. A wet scrubber may be used to control particulate air emissions from the roasting furnace, producing a wastewater stream. Leaching may be effected with sulfuric or hydrochloric acid. The leaching agent dissolves the base metals, leaving silver as a residue which can be filtered and washed for further processing. This leaching operation usually produces two wastewater streams: a silver-free leachate, which may be discharged or recycled, and a scrubber discharge stream.

In the second leaching process, silver is dissolved or stripped directly from the electrical component parts and later precipitated from solution. Nitric acid is the most common stripping agent. This leaching also results in two wastewater streams: a lead-iron residue and a scrubber discharge stream, resulting from the control of acid fumes.

In the third method, the base metals are dissolved directly using hydrochloric or sulfuric acid. The silver residue is then roasted, cast, and electrolytically refined. A scrubber stream, from control of acid fumes, and the lead-iron residue stream are sources of wastewater.

Silver in solution from leaching or direct stripping is precipitated by metallic replacement (usually with copper or zinc) and then filtered. Copper sulfate or zinc sulfate is usually the principal constituent of the supernatant and filtrate and is either purified for copper recovery or discarded. Water from washing the silver precipitate is also discharged. Wet scrubbers may provide control of acidic fumes emitted during the precipitation step, producing an additional wastewater stream.

The recovered silver is melted in a furnace and cast as ingots. Silver of insufficient purity is electrolytically refined. Particulate emissions from the melting furnace are controlled with a baghouse or scrubber. Venturi scrubbers are commonly used and a wastewater stream is discharged.

Silver-rich sludges from waste plating solutions, stripping solutions, and photographic solutions are leached and the silver recovered, resulting in a silver-rich solution. The leaching agent used is hydrochloric acid, sulfuric acid, or nitric acid. The silver-rich solution is processed through precipitation, filtration, roasting, melting, and casting steps to produce refined silver ingots.

PROCESS WASTEWATER SOURCES

The principal uses of water in secondary silver plants are:

1. Film stripping,
2. Film stripping wet air pollution control and precipitation of film stripping solutions wet air pollution control,
3. Precipitation and filtration of film stripping solutions,
4. Precipitation and filtration of photographic solutions,
5. Precipitation and filtration of photographic solutions wet air pollution control,
6. Electrolytic refining,
7. Furnace wet air pollution control,
8. Leaching,
9. Leaching wet air pollution control and precipitation of nonphotographic solutions wet air pollution control,
10. Precipitation and filtration of nonphotographic solutions, and
11. Floor and equipment washdown.

OTHER WASTEWATER SOURCES

There may be other wastewater streams associated with the production of secondary silver. These wastewater streams may include maintenance and cleanup water, and direct electrolytic refining wet air pollution control wastewater. These wastewater streams are not considered as part of this rulemaking. EPA believes that the flows and pollutant loadings associated with these streams are insignificant relative to the waste streams selected and are best handled by the appropriate permit authority on a case-by-case basis under the authority of Section 402 of the Clean Water Act.

Casting contact cooling water is not considered as part of this rulemaking because, although several plants do discharge this stream, sampling data from an integrated secondary silver secondary precious metals plant indicate that the pollutant loadings are insignificant compared with the other waste streams selected.

AGE, PRODUCTION, AND PROCESS PROFILE

Of the 61 plants recovering silver from photographic and nonphotographic materials, Figure III-4 (page 2700) shows that the plants are concentrated in the Northeast and California, with plants also located in Idaho, Utah, Louisiana, Florida, and Texas.

Table III-1 (page 2694) summarizes the general type and shows the relative ages of the secondary silver plants. Seven plants discharge directly, 26 are indirect dischargers, and 28 are zero dischargers. Of the discharging plants, five process only photographic materials, 26 process only nonphotographic materials, and two plants process both types of materials. The average plant age is between 10 and 25 years.

Table III-2 (page 2695) shows the production ranges for the 61 secondary silver plants. Over half of the plants that reported production data produce less than 50,000 troy ounces of silver per year. Eight of these plants produce over 1,000,000 troy ounces of silver per year.

Table III-3 (page 2696) provides a summary of the plants having the various secondary silver processes. The number of plants generating wastewater from the processes is also shown.

Table III-1

INITIAL OPERATING YEAR (RANGE) SUMMARY OF PLANTS IN THE SECONDARY SILVER SUBCATEGORY BY DISCHARGE TYPE

Type of Plant Discharge	1983-1974 0-10	1973-1969 10-15	1968-1959 15-25	1958-1949 25-35	1948-1939 35-45	1938-1929 45-55	1928-1919 55-65	1918-1904 65-80	Before 1904 80+	Not Reported in dcp	Total
Direct	0	1	0	2	0	1	1	0	0	2	7
Indirect	8	6	4	1	1	0	1	3	1	1	26
Zero	8	3	7	1	1	0	0	0	0	8	28
Total	16	10	11	4	2	1	2	3	1	11	61

Table III-2

PRODUCTION RANGES FOR THE SECONDARY SILVER SUBCATEGORY

	Silver Production Ranges (troy ounces/year)					
Type of Plant	0 - 50,000	50,001-100,000	100,001-500,000	500,001-1,000,000	1,000,000+	Not Reported in dcp
Direct Discharger	3	0	2	0	1	1
Indirect Discharger	21	0	3	1	1	0
Zero Discharger	5	1	7	1	6	8
Total	29	1	12	2	8	9

Table III-3

SUMMARY OF SECONDARY SILVER SUBCATEGORY PROCESSES AND ASSOCIATED WASTE STREAMS

Process	Number of Plants With Process	Number of Plants Generating Wastewater*
Film Stripping	5	-
o Film Base Processing	3	1
o Precipitation and Filtration	5	4
o Air Pollution Control	1	1
Photographic Solution Processing	7	-
o Precipitation and Filtration	7	7
o Air Pollution Control	3	3
Electrolytic Refining	15	13
Furnace Air Pollution Control	27	12
Casting	34	16
Leaching	13	11
o Air Pollution Control	13†	13
Nonphotographic Solution Processing	27	-
o Precipitation and Filtration	27	27

* Through reuse or evaporation practices, a plant may "generate" a wastewater from a particular process but not discharge it.

† Includes two scrubbers over leaching and precipitation of nonphotographic solutions processes

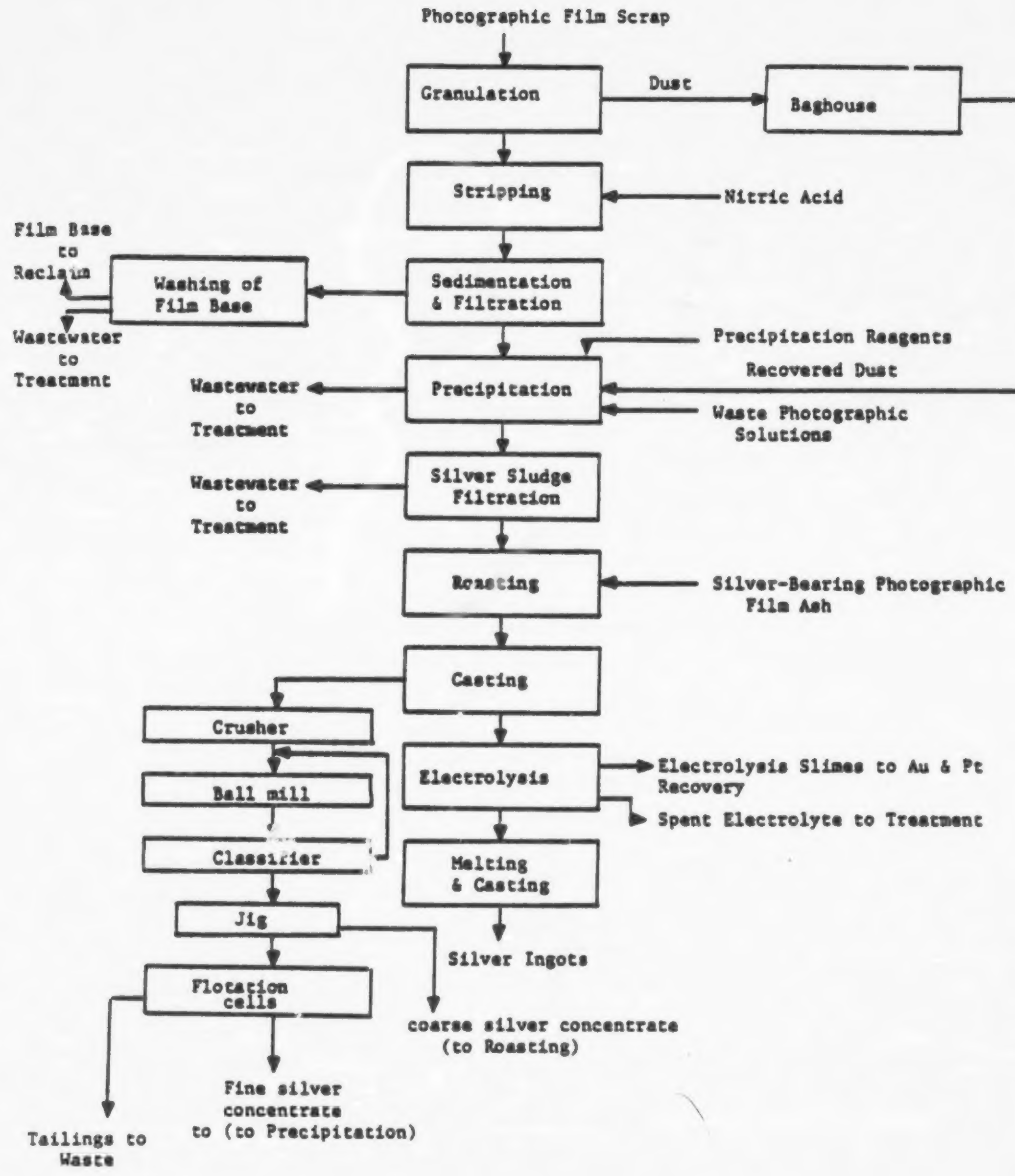

Photographic Film Scrap
Granulation
Dust
Baghouse
Stripping
Nitric Acid
Film Base to Reclaim
Washing of Film Base
Sedimentation & Filtration
Wastewater to Treatment
Precipitation Reagents
Recovered Dust
Wastewater to Treatment
Precipitation
Waste Photographic Solutions
Wastewater to Treatment
Silver Sludge Filtration
Roasting
Silver-Bearing Photographic Film Ash
Casting
Crusher
Ball mill
Classifier
Jig
Flotation cells
Electrolysis
Electrolysis Slimes to Au & Pt Recovery
Spent Electrolyte to Treatment
Melting & Casting
Silver Ingots
coarse silver concentrate (to Roasting)
Fine silver concentrate to (to Precipitation)
Tailings to Waste

Figure III-1

SILVER REFINING FROM PHOTOGRAPHIC MATERIALS

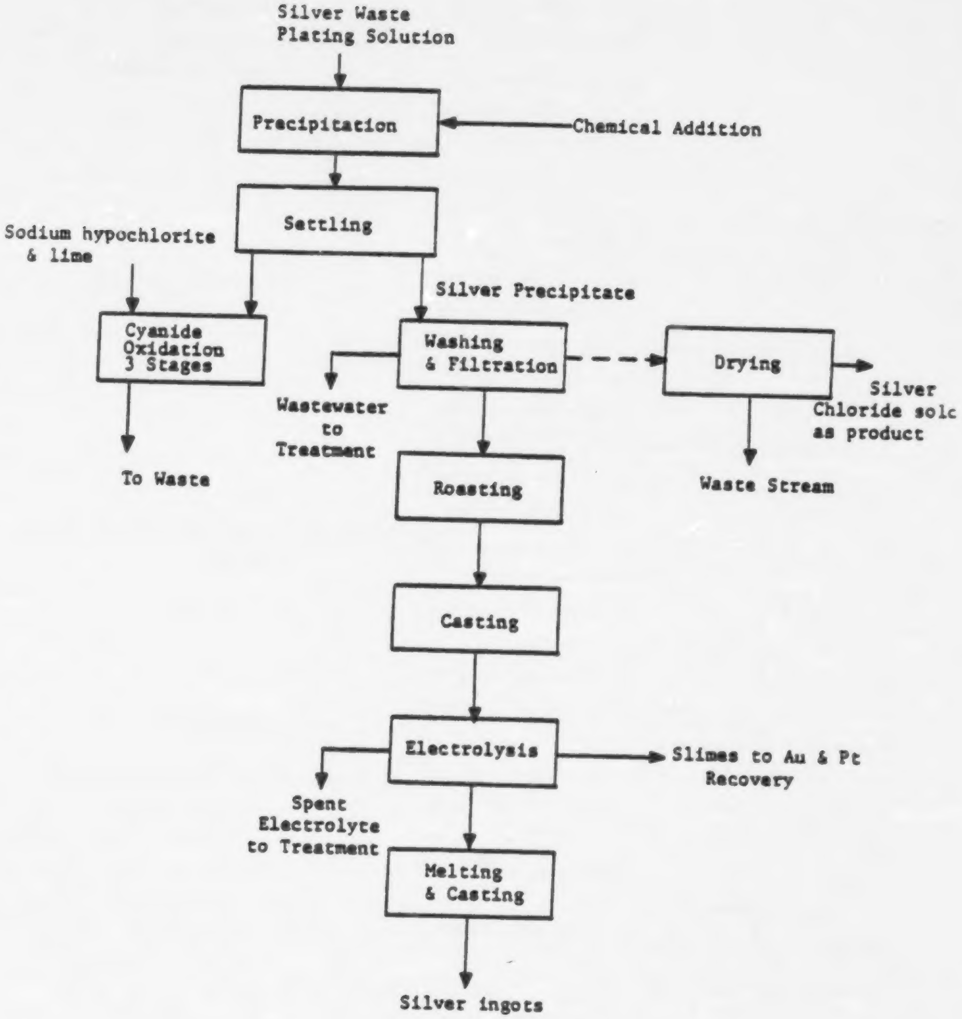

Silver Waste Plating Solution
Precipitation
Chemical Addition
Settling
Sodium hypochlorite & lime
Silver Precipitate
Cyanide Oxidation 3 Stages
Washing & Filtration
Drying
Silver Chloride solc as product
Wastewater to Treatment
To Waste
Roasting
Waste Stream
Casting
Electrolysis
Slimes to Au & Pt Recovery
Spent Electrolyte to Treatment
Melting & Casting
Silver ingots

Figure III-2

SILVER REFINING FROM WASTE PLATING SOLUTIONS

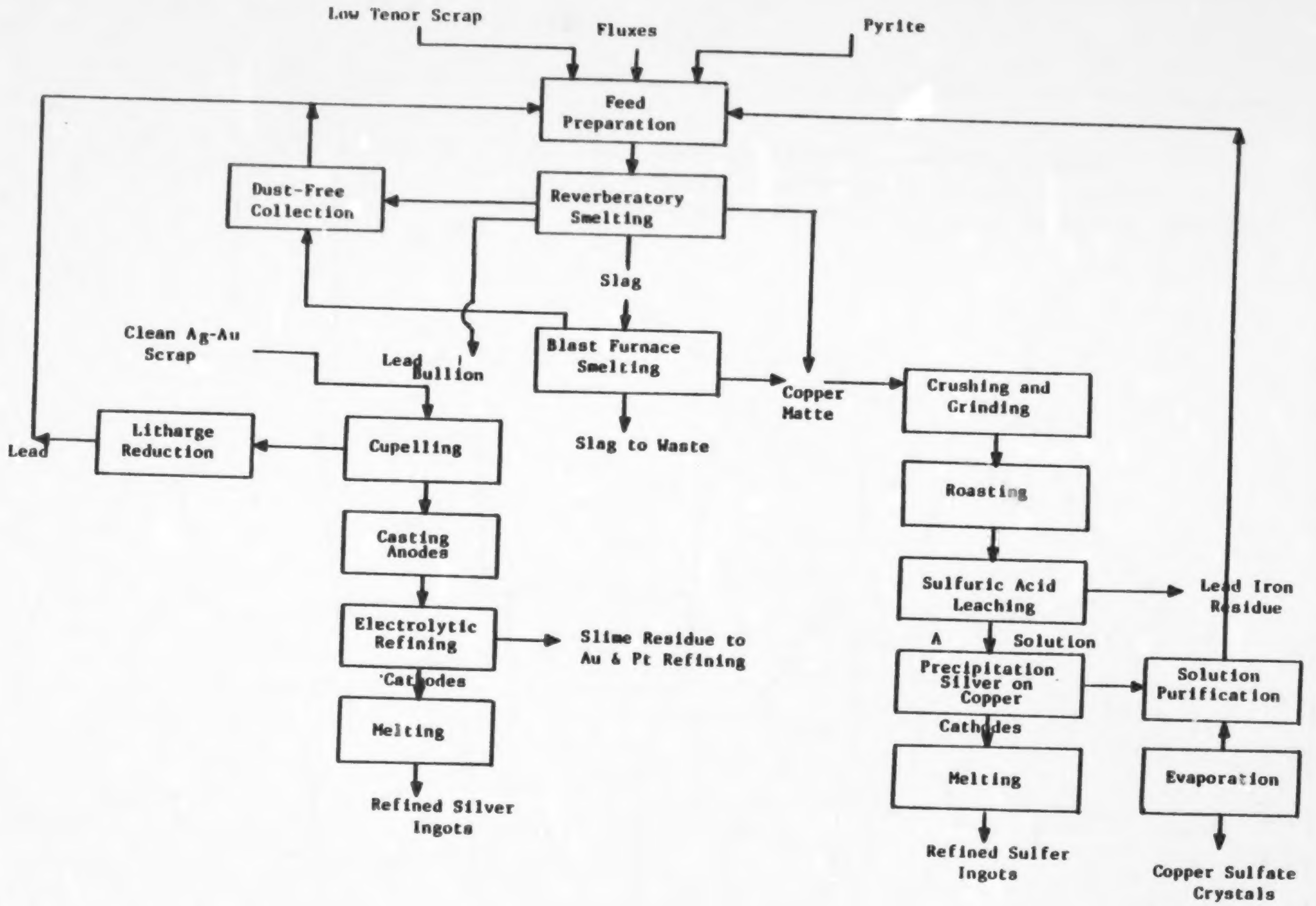

Low Tenor Scrap
Fluxes
Pyrite
Feed Preparation
Dust-Free Collection
Reverberatory Smelting
Slag
Blast Furnace Smelting
Slag to Waste
Copper Matte
Clean Ag-Au Scrap
Lead Bullion
Lead
Litharge Reduction
Cupelling
Casting Anodes
Electrolytic Refining
Slime Residue to Au & Pt Refining
Cathodes
Melting
Refined Silver Ingots
Crushing and Grinding
Roasting
Sulfuric Acid Leaching
Lead Iron Residue
A
Solution
Precipitation Silver on Copper
Solution Purification
Cathodes
Melting
Evaporation
Refined Sulfer Ingots
Copper Sulfate Crystals

Figure III-3

SECONDARY SILVER PRODUCTION PROCESS FROM NONPHOTOGRAPHIC SCRAP

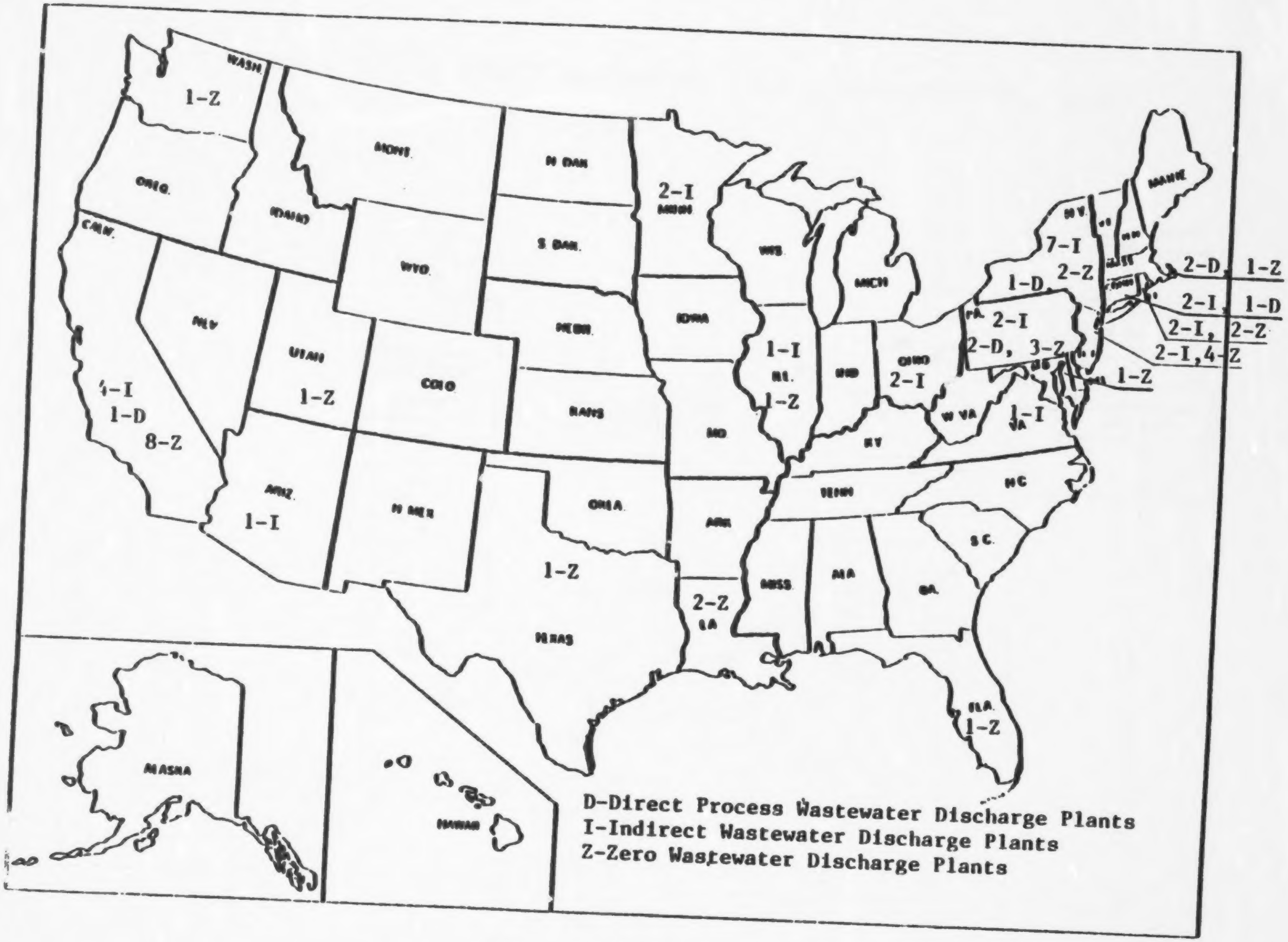

WASH. 1-Z
ORIG.
IDAHO
MONT.
N DAK
S DAK
WYO
MINN 2-I
CALIF. 4-I 1-D 8-Z
NEV
UTAH 1-Z
COLO
NEBR.
KANS
IOWA
WIS
MICH
MO
ILL. 1-I 1-Z
IND
OHIO 2-I
N.Y. 7-I 1-D 2-Z
PA. 2-I 2-D, 3-Z
MAINE
2-D, 1-Z
2-I, 1-D
2-I, 2-Z
2-I,4-Z
1-Z
W VA
VA 1-I
KY
N C
TENN
S.C.
GA.
ALA
MISS
ARK
LA 2-Z
OKLA
TEXAS 1-Z
ARIZ. 1-I
N MEX
FLA. 1-Z
ALASKA
HAWAII
D-Direct Process Wastewater Discharge Plants
I-Indirect Wastewater Discharge Plants
Z-Zero Wastewater Discharge Plants

Figure III-4

GEOGRAPHIC LOCATIONS OF SECONDARY SILVER PLANTS

SECTION IV

SUBCATEGORIZATION

This section summarizes the factors considered during the designation of the secondary silver subcategory and its related subdivisions.

The factors listed for general subcategorization were each evaluated when considering subdivision of the secondary silver subcategory. In the discussion that follows, the factors will be described as they pertain to this particular subcategory.

The rationale for considering segmentation of the secondary silver subcategory is based primarily on the production processes used. Within the subcategory, a number of different operations are performed, which may or may not have a water use or discharge, and which may require the establishment of separate effluent limitations and standards. While the secondary silver industry is considered a single subcategory, a more thorough examination of the production processes, water use and discharge practices, and pollutant generation rates has illustrated the need for limitations and standards based on a specific set of wastewater streams. Limitations and standards will be based on specific flow allowances for the following subdivisions:

1. Film stripping,
2. Film stripping wet air pollution control and precipitation of film stripping solutions wet air pollution control,
3. Precipitation and filtration of film stripping solutions,
4. Precipitation and filtration of photographic solutions,
5. Precipitation and filtration of photographic solutions wet air pollution control,
6. Electrolytic refining,
7. Furnace wet air pollution control,
8. Leaching,
9. Leaching wet air pollution control and precipitation of nonphotographic solutions wet air pollution control,
10. Precipitation and filtration of nonphotographic solutions, and
11. Floor and equipment washdown.

A number of other factors considered in this evaluation were shown to be inappropriate bases for further segmentation. Air pollution control methods, treatment costs, nonwater quality aspects, and total energy requirements are functions of the selected subcategorization factors -- raw materials and production processes. As such, they support the method of subcategorization which has been developed. Factors determined to be inappropriate for use as bases for subcategorization are discussed briefly below.

PLANT SIZE

It is difficult to categorize secondary silver plants on the basis of size. The individual processes involved in silver production often process different amounts of silver-bearing material. Therefore, it is more appropriate to categorize silver plants on the basis of process production, e.g., precipitation production.

PLANT AGE

Plants within the secondary silver subcategory differ in age, in terms of initial operating year. However, to remain competitive, plants are constantly modernized. Modifications to process operations have been made, resulting in greater production efficiency and reduced air pollution emissions. As a result, neither the concentration of constituents in wastewater nor the capability to meet the limitations is related to plant age.

PRODUCTION NORMALIZING PARAMETERS

The effluent limitations and standards developed in this document establish mass limitations for the discharge of specific pollutant parameters. To allow these limitations to be applied to plants with various production capacities, the mass of pollutant discharged must be related to a unit of production. This factor is known as the production normalizing parameter (PNP). In general, the actual silver production from the respective manufacturing process is used as the PNP. This is based on the principle that the amount of water generated is proportional to the amount of product made. Therefore, the PNPs for the 11 secondary silver subdivisions are as follows:

	Building Block	PNP
1.	Film stripping	troy ounces of silver produced from film stripping
2.	Film stripping wet air pollution control and precipitation of film stripping solutions wet air pollution control	troy ounces of silver produced from precipitation and filtration of film stripping solutions
3.	Precipitation and filtration of film stripping solutions	troy ounces of silver precipitated
4.	Precipitation and filtration of photographic solutions	troy ounces of silver precipitated
5.	Precipitation and filtration of photographic solutions wet air pollution control	troy ounces of silver precipitated

6.	Electrolytic refining	troy ounces of silver from electrolytic refining
7.	Furnace wet air pollution control	troy ounces of silver smelted, roasted, or dried
8.	Leaching	troy ounces of silver produced from leaching
9.	Leaching wet air pollutio control and precipitation of nonphotographic solutions wet air pollution control	troy ounces of silver produced from leaching or silver precipitated
10.	Precipitation and filtration of non-photographic solutions	troy ounces of silver precipitated
11.	Floor and equipment washdown	troy ounces of silver produced

SECTION V

WATER USE AND WASTEWATER CHARACTERISTICS

This section describes the characteristics of wastewater associated with the secondary silver subcategory. Data used to quantify wastewater flow and pollutant concentrations are presented, summarized, and discussed. The contribution of specific production processes to the overall wastewater discharge from secondary silver plants is identified whenever possible.

Two principal data sources were used in the development of effluent limitations and standards for this subcategory; data collection portfolios (dcp) and field sampling results. Data collection portfolios contain information regarding wastewater flows and production levels. Data were also collected through comments and a special request.

In order to quantify the pollutant discharge from secondary silver plants, a field sampling program was conducted. A complete list of the pollutants considered and a summary of the techniques used in sampling and laboratory analyses are included in Section V of Vol. I. Wastewater samples were collected in two phases: screening and verification. The first phase, screen sampling, was to identify which toxic pollutants were present in the wastewaters from production of the various metals. Screening samples were analyzed for 125 of the 126 toxic pollutants and other pollutants deemed appropriate. (Because the analytical standard for TCDD was judged to be too hazardous to be made generally available, samples were never analyzed for this pollutant. There is no reason to expect that TCDD would be present in secondary silver wastewater). A total of 10 plants were selected for screen sampling in the nonferrous metals manufacturing category, one of these being a secondary silver plant. Of the 36 plants selected for verification sampling, three were from the secondary silver subcategory. In general, the samples were analyzed for three classes of pollutants: toxic organic pollutants, toxic metal pollutants, and criteria pollutants (which includes both conventional and nonconventional pollutants).

As described in Section IV of this supplement, the secondary silver subcategory has been further segmented into 11 subdivisions or building blocks, so that the promulgated regulation contains mass discharge limitations and standards for 11 manufacturing processes discharging process wastewater. Differences in the wastewater characteristics associated with these subdivisions are to be expected. For this reason, wastewater streams corresponding to each subdivision are addressed separately in the discussions that follow.

The wastewater data presented in this section were evaluated in light of production process information compiled during this study. As a result, it was possible to identify the principal wastewater sources in the secondary silver subcategory. They are:

1. Film stripping,
2. Film stripping wet air pollution control and precipitation of film stripping solutions wet air pollution control,
3. Precipitation and filtration of film stripping solutions,
4. Precipitation and filtration of photographic solutions,
5. Precipitation and filtration of photographic solutions wet air pollution control,
6. Electrolytic refining,
7. Furnace wet air pollution control,
8. Leaching,
9. Leaching wet air pollution control and precipitation of nonphotographic solutions wet air pollution control,
10. Precipitation and filtration of nonphotographic solutions, and
11. Floor and equipment washdown.

In the proposed development document, separate subdivisions were identified for precipitation and filtration of film stripping solutions wet air pollution control, casting contact cooling water, casting wet air pollution control, and precipitation and filtration of nonphotographic solutions wet air pollution control. Based on new data gathered since proposal from secondary precious metals plants' dcp, sampling at two integrated secondary silver and secondary precious metals plants, and re-evaluation of existing data, these subdivisions were either combined with other subdivisions or deleted. A subdivision for floor and equipment washdown also was added. The reasons for these changes are discussed in detail in Section IX - Wastewater Discharge Rates.

Although flow and production data were collected in secondary precious metals dcp in the nonferrous metals manufacturing category, these data were not used to modify the proposed regulatory flow allowances. The new data support the proposed flow allowance and the Agency did not receive any comments suggesting that the allowances should be revised. The new flow data are included in the water use and discharge tables at the end of this section.

Additionally, since the dcp were collected, the Agency has learned that one secondary silver plant has closed and six plants no longer process secondary silver. Flow and production data (when available) for these plants are presented in this section and in the remainder of the development document. These data are an integral part of the BPT and BAT effluent limitations because the processes remain representative in determining BPT and BAT and flow rates. Therefore, it is necessary to present this information so that the effluent limitations are documented.

WASTEWATER FLOW RATES

Data supplied by dcp responses were evaluated, and two flow-to-production ratios were calculated for each stream. The two ratios, water use and wastewater discharge flow, are differentiated by the flow value used in calculation. Water use is defined as the volume of water or other fluid (e.g., leachate, spent electrolyte) required for a given process per mass of silver product and is therefore based on the sum of recycle and make-up flows to a given process. Wastewater flow discharged after pretreatment or recycle (if these are present) is used in calculating the production normalized flow--the volume of wastewater discharged from a given process to further treatment, disposal, or discharge per mass of silver produced. Differences between the water use and wastewater flows associated with a given stream result from recycle, evaporation, and carryover on the product. The production values used in calculation correspond to the production normalizing parameter, PNP, assigned to each stream, as outlined in Section IV. The production normalized flows were compiled and statistically analyzed by stream type. Where appropriate, an attempt was made to identify factors that could account for variations in water use. This information is summarized in this section. A similar analysis of factors affecting the wastewater values is presented in Sections IX, X, XI, and XII where representative BPT, BAT, BDT, and pretreatment discharge flows are selected for use in calculating the effluent limitations and standards. As an example, silver precipitation and filtration scrubbing wastewater flow is related to precipitate production. As such, the discharge rate is expressed in liters of scrubber wastewater discharged per troy ounce of silver produced by precipitation.

WASTEWATER CHARACTERIZATION DATA

In order to quantify the concentrations of pollutants present in wastewater from secondary silver plants, wastewater samples were collected at four plants. Diagrams indicating the sampling sites and contributing production processes are shown in Figures V-1 through V-4 (pages 2714 - 2723).

The raw wastewater sampling data for the secondary silver subcategory are presented in Tables V-2, V-5, and V-8 (pages 2715, 2724, and 2728. Treated wastewater sampling data are shown in Tables V-13 through V-16 (pages 2736 - 2740). The stream codes presented in the tables may be used to identify the location of each of the samples on the process flow diagrams in Figures V-1 through V-4. Where no data are listed for a specific day of sampling, the wastewater samples for the stream were not collected. If the analysis did not detect a pollutant in a waste stream, the pollutant was omitted from the table.

The data tables include some samples measured at concentrations considered not quantifiable. The base-neutral extractable, acid fraction extractable, and volatile organics are generally considered not quantifiable at concentrations equal to or less than 0.010 mg/l. Below this concentration, organic analytical results are not quantitatively accurate; however, the analyses are useful to indicate the presence of a particular pollutant. The pesticide fraction is considered not quantifiable at concentrations equal to or less than 0.005 mg/l. Nonquantifiable results are designated in the tables with an asterisk (double asterisk for pesticides).

These detection limits shown on the data tables are not the same in all cases as the published detection limits for these pollutants by the same analytical methods. The detection limits used were reported with the analytical data and hence are the appropriate limits to apply to the data. Detection limit variation can occur as a result of a number of laboratory-specific, equipment-specific, and daily operator-specific factors. These factors can include day-to-day differences in machine calibration, variation in stock solutions, and variation in operators.

The statistical analysis of data includes some samples measured at concentrations considered not quantifiable. Data reported as an asterisk are considered as detected but below quantifiable concentrations, and a value of zero is used for averaging. Toxic organic, nonconventional, and conventional pollutant data reported with a "less than" sign are considered as detected, but not further quantifiable. A value of zero is also used for averaging. If a pollutant is reported as not detected, it is excluded in calculating the average. Finally, toxic metal values reported as less than a certain value were considered as not detected and a value of zero is used in the calculation of the average. For example, three samples reported as ND, *, and 0.021 mg/l have an average value of 0.010 mg/l.

The method by which each sample was collected is indicated by number, as follows:

1 one-time grab
2 24-hour manual composite
3 24-hour automatic composite
4 48-hour manual composite
5 48-hour automatic composite
6 72-hour manual composite
7 72-hour automatic composite

In the 1977 data collection portfolios, the secondary silver plants which discharge wastewater were asked to specify the presence or absence of the toxic pollutants in their effluent. Of the 44 secondary silver plants submitting a 1977 dcp, 19 did not respond to this portion of the questionnaire. All plants responding to the organic compounds portion of the questionnaire reported that all toxic organic pollutants were known to be absent or believed to be absent from their wastewater.

The responses for the toxic metals and cyanide are summarized below:

	Known	Believed	Believed	Known
Antimony	2	4	14	5
Arsenic	1	2	16	6
Beryllium	0	2	16	7
Cadmium	4	5	10	6
Chromium	5	4	10	6
Copper	10	4	6	5
Cyanide	4	1	13	7
Lead	7	4	8	6
Mercury	1	2	16	6
Nickel	8	3	9	5
Selenium	1	2	15	7
Silver	13	5	3	4
Thallium	0	1	16	8
Zinc	10	4	7	4

WASTEWATER CHARACTERISTICS AND FLOWS BY SUBDIVISION

Since secondary silver production involves 11 principal sources of wastewater and each has potentially different characteristics and flows, the wastewater characteristics and discharge rates corresponding to each subdivision will be described separately. A brief description of why the associated production processes generate a wastewater and explanations for variations of water use within each subdivision will also be discussed.

FILM STRIPPING

Photographic film may be stripped of emulsion and the silver precipitated. The film base can be screened and rinsed, producing wastewater. Water discharge rates are presented in Table V-1 (page 2714) in liters per troy ounce of silver produced from film stripping. Table V-2 (page 2715) (stream 14) shows combined raw wastewater data from film stripping and wet air pollution control on film stripping and film stripping precipitation. Data are not available for separate waste streams because discrete points in each stream were not accessible. However, based on the combined wastewater data and the raw materials and process used, film stripping wastewater should contain toxic organics and metals, cyanide, and total suspended solids above treatable concentrations, as well as phenols.

FILM STRIPPING WET AIR POLLUTION CONTROL AND PRECIPITATION OF FILM STRIPPING SOLUTIONS WET AIR POLLUTION CONTROL

One plant engaged in film stripping uses a wet scrubber to control air emissions. This plant uses the same scrubber to control emissions from film stripping and film stripping precipitation. A 99+ percent recycle of the scrubber water is maintained and the discharge rate is 0.034 liters per troy ounce of silver produced from precipitation and filtration of film stripping solutions. Table V-2 (stream 14) shows combined raw wastewater data from film stripping and wet air pollution control on film stripping and film stripping precipitation. Data are not available for separate waste streams because discrete points in each stream were not accessible. However, based on the combined wastewater data and the raw materials and process used, film stripping wet air pollution control wastewater should contain toxic organics and metals, cyanide, phenolics, and total suspended solids.

PRECIPITATION AND FILTRATION OF FILM STRIPPING SOLUTIONS

The solution resulting from stripping granulated film is treated to precipitate the silver. After settling or filtration, the silver-free solution may be discarded as wastewater. Four of the five photographic plants that use this process discharge a waste stream. The water discharge rates, reported in liters per troy ounce of silver precipitated, are shown in Table V-3 (page 2722). Sampling data for film stripping solutions precipitation are summarized in Table V-2 (Stream 12). Raw wastewater from this process contains toxic organics and metals, cyanide, phenolics, and total suspended solids at treatable concentrations.

PRECIPITATION AND FILTRATION OF PHOTOGRAPHIC SOLUTIONS

Silver can be precipitated from discarded photographic hypo solutions. After filtration, the silver-free solution constitutes a waste stream. Solutions resulting from photographic sludges are also included in this subdivision. All seven plants which have precipitation processes discharge process wastewater. The discharge rates from these plants, presented in liters per troy ounce of silver precipitated, are shown in Table V-4 (page 2723). The Agency did not sample the raw wastewater from silver solution precipitation directly; however, wastewater samples were collected after filtering with sawdust (which is part of the process). This wastewater contains 1,2-dichloroethane, chloroform, phthalates, and tetrachloroethylene, all above treatable concentrations (0.025 to 0.132 mg/l). Toxic metals are also found, including a high concentration of zinc (200 mg/l). Ammonia (4,630 mg/l), and chloride (734 mg/l) are also present. Total suspended solids are evident, but most solids in the raw wastewater were probably removed by the filter. Raw wastewater sampling data are given in Table V-5 (page 22724).

PRECIPITATION AND FILTRATION OF PHOTOGRAPHIC SOLUTIONS WET AIR POLLUTION CONTROL

Of the seven photographic silver plants precipitating silver solutions, three use wet air pollution control; two of these discharge wastewater from wet scrubbers. The water discharge flow rates are shown in Table V-6. Although wastewater samples were not collected from precipitation of photographic solutions wet air pollution control, raw wastewater data are available from a film stripping precipitation scrubber. The wastewater characteristics for the two scrubbers are expected to be similar because of the similarities in the raw materials and processes used. Wastewater samples collected from the analogous wet scrubber stream contain toxic organics and metals, cyanide, and total suspended solids above treatable concentrations.

ELECTROLYTIC REFINING

Fifteen plants use electrolytic refining as a purification step in secondary silver processing. Thirteen plants generate waste streams consisting of spent electrolyte and wash water; 12 of those discharge the wastewater. Table V-7 (page 2725) shows the water discharge rates in liters per troy ounce of silver refined.

Electrolytic refining is similar for photographic and nonphotographic plants, therefore wastewater from each may have similar characteristics. Table V-8 (page 2728) summarizes the raw wastewater sampling data for the toxic and selected conventional and nonconventional pollutants.

The samples were collected at a nonphotographic plant from a combined waste stream comprised of raw wastewater from electrolytic refining, as well as metal-depleted solutions. This raw wastewater contains toxic organics and metals, ammonia, fluoride, cyanide, and total suspended solids above treatable concentrations.

FURNACE WET AIR POLLUTION CONTROL

Of the secondary silver plants with reverberatory furnaces, incinerators, or casting furnaces, 27 control off-gas emissions. Twelve plants use wet scrubbers, and four of these discharge wastewater, as shown in Table V-9 (page 2732). The Agency did not collect samples from furnace scrubber wastewater at a secondary silver plant before proposal. However, after proposal, samples of this wastewater were collected at an integrated secondary silver and secondary precious metals facility. This plant processes nonphotographic materials and the scrubber controls off-gas emissions from a furnace used to smelt silver, gold, platinum, and palladium. These data are presented in the administrative record supporting this regulation. Furnace scrubber wastewater contains a treatable concentration of total suspended solids (5,600 mg/l) and has a pH of approximately 7.

LEACHING

In nonphotographic materials plants, leaching is used to recover silver from silver sludges and copper matte associated with the melting of electrical component parts. Of the 13 nonphotographic plants that leach, 11 produce wastewater, consisting of either silver-free leachate or lead-iron residue. Water discharge rates are given in Table V-12 (page 2735) in liters per troy ounce of silver produced from leaching.

Table V-8 (page 2728) (stream 40) shows combined raw wastewater data from nonphotographic solutions precipitation and electrolytic refining. Leaching wastewaters have similar characteristics as precipitation wastewater because of the nature of the nonphotographic materials processed. Data are not available for separate waste streams because discrete points in each stream were not accessible. However, based on the combined wastewater data and the raw materials and process used, raw wastewater from leaching should contain toxic organics and metals, ammonia, fluoride, cyanide, phenolics, and total suspended solids above treatable concentrations.

LEACHING WET AIR POLLUTION CONTROL AND PRECIPITATION OF NONPHOTOGRAPHIC SOLUTIONS WET AIR POLLUTION CONTROL

For leaching emissions, discharge rates are shown in Table V-13 (page 2736). All 13 of the plants with leaching and precipitation emissions control discharge wastewater. For proposal, the Agency did not have discrete samples of this waste stream. After proposal, EPA collected samples of scrubbers over leaching and precipitation processes at two integrated secondary silver and secondary precious metals plants. These plants also process gold, platinum, and palladium from nonphotographic materials. The scrubbers control emissions from the secondary silver and the secondary precious metals leaching and precipitation processes. The scrubber wastewater contains treatable concentrations of toxic metals and total suspended solids. The pH is approximately 8 when a caustic solution is used as a scrubber liquor. At plants scrubbing with water only, this wastewater is expected to be acidic. The wastewater data for this stream are presented in the administrative record supporting this regulation.

PRECIPITATION AND FILTRATION OF NONPHOTOGRAPHIC SOLUTIONS

Silver may be recovered by precipitation from leachates, waste silver-plating solutions or melted silver scrap. Twenty-seven nonphotographic plants report this process, and all 27 discharge wastewater. Depleted solutions may be discarded as wastewater, along with wash water and silver-free filtrates. Discharge water rates are presented in Table V-15 (page 2740).

Table V-8 (stream 40) shows combined raw wastewater data from nonphotographic solutions precipitation and electrolytic refining. Data are not available for separate waste streams because discrete points in each stream were not accessible. However, based on the combined wastewater data and the raw materials and process used, precipitation of nonphotographic solutions wastewater should be characterized by the presence of toxic organics and metals, ammonia, cyanide, chloride, fluoride, phenolics, and suspended solids above treatable concentrations.

FLOOR AND EQUIPMENT WASHDOWN

Many plants wash equipment and floors to recover silver values that may be contained in accidental leaks and spills of process solutions. Flow data on the floor wash were not generally available in the data collection portfolios. However, data from a sampling effort at one secondary silver-secondary precious metals integrated plant and one secondary precious metals plant show that one liter per troy ounce of washdown water is typically generated. Sampling data collected at the two plants show this wastewater to contain treatable concentrations of toxic metals and total suspended solids. The flow and sampling data for this waste stream are included in the administrative record supporting this regulation.

TABLE V-1

WATER USE AND DISCHARGE RATES FOR FILM STRIPPING

(l/troy ounce of silver produced from film stripping)

Plant Code	Percent Recycle	Production Normalized Water Use	Production Normalized Discharge Flow
30927	0	50.35	50.35
596	NR	NR	NR
74	NR	NR	NR

NR = data not reported in dcp.

Table V-2

SECONDARY SILVER SAMPLING DATA
PHOTOGRAPHIC - MISCELLANEOUS
RAW WASTEWATER

Pollutant(a)	Stream Code	Sample Type†	Concentrations (mg/l, except as noted) Source(b)	Day 1	Day 2	Day 3	Average
4. benzene	12	1		0.084			0.084
	14	1		0.17	0.132	2.05	0.784
	16	1		0.149			0.149
6. carbon tetrachloride	12	1		ND			
	14	1		ND	ND	0.07	0.07
	16	1		ND			
10. 1,2-dichloroethane	12	1		0.061			0.061
	14	1		0.58	ND	ND	0.58
	16	1		0.156			0.156
11. 1,1,1-trichloroethane	12	1		ND			
	14	1		ND	ND	ND	
	16	1		0.022			0.022
23. chloroform	12	1		0.244			0.244
	14	1		1.31	ND	ND	1.31
	16	1		0.36			0.36
29. 1,1-dichloroethylene	12	1		ND			
	14	1		0.33	ND	ND	0.33
	16	1		6.1			6.1
38. ethylbenzene	12	1		0.017			0.017
	14	1		0.016	*	ND	0.008
	16	1		*			*

Table V-2 (Continued)

SECONDARY SILVER SAMPLING DATA
PHOTOGRAPHIC - MISCELLANEOUS
RAW WASTEWATER

Pollutant(a)	Stream Code	Sample Type†	Source(b)	Concentrations (mg/l, except as noted) Day 1	Day 2	Day 3	Average
44. methylene chloride	12	1		0.67			0.67
	14	1		3.23	ND	ND	3.23
	16	1		3.1		ND	3.1
66. bis(2-ethylhexyl) phthalate	12	1		*			*
	14	1		0.034			0.034
	16	1		0.011			0.011
68. di-n-butyl phthalate	12	1		0.015			0.015
	14	1		0.014			0.015
	16	1		0.047			0.047
69. di-n-octyl phthalate	12	1		0.033			0.033
	14	1		0.058			0.058
	16	1		ND			
70. diethyl phthalate	12	1		ND			
	14	1		0.038			
	16	1		ND			
85. tetrachloro-ethylene	12	1		*			*
	14	1		0.087	ND	ND	0.087
	16	1		0.042			0.041
86. toluene	12	1		0.029			0.029
	14	1		0.027	ND	0.032	0.03
	16	1		0.013			0.013

Table V-2 (Continued)

SECONDARY SILVER SAMPLING DATA
PHOTOGRAPHIC - MISCELLANEOUS
RAW WASTEWATER

Pollutant(a)	Stream Code	Sample Type†	Concentrations (mg/l, except as noted) Source(b)	Day 1	Day 2	Day 3	Average
87. trichloro-ethylene	12	1		0.473			0.473
	14	1		0.93	ND	ND	0.93
	16	1		0.832			0.832
91. chlordane	12	1		**			**
	16	1		<0.01			<0.01
106. PCB-1242 (c)	12	1		<0.014			<0.0
107. PCB-1254 (c)	16	1		<0.007			<0.0
108. PCB-1221 (c)	230	6		0.012			0.012
109. PCB-1232 (d)	12	1		<0.017			<0.017
110. PCB-1248 (d)	16	1		<0.015			<0.015
111. PCB-1260 (d)	230	6		0.012			0.012
113. toxaphene	12	1		**			**
	16	1		<0.01			<0.01
	230	1		ND			
114. antimony	12	1		12			12.0
	14	1		0.7			0.7
	16	1		1.5			1.5
115. arsenic	12	1		2.2			2.2
	14	1		0.2			0.2
	16	1		1.9			1.9

Table V-2 (Continued)

SECONDARY SILVER SAMPLING DATA
PHOTOGRAPHIC - MISCELLANEOUS
RAW WASTEWATER

Pollutant(a)	Stream Code	Sample Type†	Concentrations (mg/l, except as noted) Source(b)	Day 1	Day 2	Day 3	Average
117. beryllium	12	1		<0.02			<0.02
	14	1		<0.02			<0.02
	16	1		<0.02			<0.02
118. cadmium	12	1		0.37			0.37
	14	1		5			5.0
	16	1		0.65			0.65
119. chromium	12	1		100			100.0
	14	1		9			9.0
	16	1		7			7.0
120. copper	12	1		30			30.0
	14	1		2			2.0
	16	1		0.72			0.72
121. cyanide	12	1		5.95			5.95
	14	1		1.83	1.13	1.29	1.416
	16	1		0.311			0.311
122. lead	12	1		9			9.0
	14	1		2			2.0
	16	1		6			6.0
123. mercury	12	1		0.017			0.017
	16	1		0.0008			0.0008

Table V-2 (Continued)

SECONDARY SILVER SAMPLING DATA
PHOTOGRAPHIC - MISCELLANEOUS
RAW WASTEWATER

Pollutant(a)	Stream Code	Sample Type†	Concentrations (mg/l, except as noted) Source(b)	Day 1	Day 2	Day 3	Average
124. nickel	12	1		<0.5			<0.5
	14	1		1			1.0
	16	1		2			2.0
125. selenium	12	1		0.9			0.9
	14	1		0.6			0.6
	16	1		0.25			0.25
126. silver	12	1		5			5.0
	16	1		3			3.0
127. thallium	12	1		0.4			0.4
	16	1		0.2			0.2
12[illegible]. zinc	12	1		20			20.0
	14	1		4			4.0
	16	1		10			10.0
Nonconventionals							
chemical oxygen demand (COD)	12	1	10,100				10,100
	16	1	6,460				6,460
	230	6	14,800				14,800
phenols (total; by 4-AAP method)	12	1		0.197			0.197
	14	1		32	28.8	16.7	25.8
	16	1		62.5			62.5

Table V-2 (Continued)

SECONDARY SILVER SAMPLING DATA
PHOTOGRAPHIC - MISCELLANEOUS
RAW WASTEWATER

Pollutant(a)	Stream Code	Sample Type†	Concentrations (mg/l, except as noted) Source(b)	Day 1	Day 2	Day 3	Average
total organic carbon (TOC)	12	1		4,040			4,040
	16	1		2,410			2,410
	230	6		13,040			13,040
Conventionals							
oil and grease	12	1		111			111
	14	1		130			130
	16	1		20			20
total suspended solids (TSS)	12	1		3,664			3,664
	16	1		162			162.0
	230	6		484			484.0
pH (standard units)	12	1		2.95			
	14	1		8.4			
	16	1		1.1	6.05	5.88	

(a) Three samples were analyzed for the acid extractable pollutants; none were detected. The samples were also analyzed for pesticides, but none were detected, except as noted.

(b) No source water samples were analyzed.

(c), (d) Reported together

Table V-2 (Continued)

SECONDARY SILVER SAMPLING DATA
PHOTOGRAPHIC - MISCELLANEOUS
RAW WASTEWATER

†Sample type. Note: These numbers also apply to subsequent data tables.

1 one-time grab
2 24-hour manual composite
3 24-hour automatic composite
4 48 hour manual composite
5 48 hour automatic composite
6 72 hour manual composite
7 72 hour automatic composite

* Less than or equal to 0.01 mg/l

** Less than or equal to 0.005 mg/l

TABLE V-3

WATER USE AND DISCHARGE RATES FOR PRECIPITATION AND FILTRATION OF FILM STRIPPING SOLUTIONS

(l/troy ounce of silver produced from film stripping)

Plant Code	Percent Recycle	Production Normalized Water Use	Production Normalized Discharge Flow
30927	0	112.7	112.7
596	0	2.31	2.31
74	0	0.74	0.74
566	NR	NR	NR
602		No Wastewater Produced	

NR = data not reported in dcp.

TABLE V-4

WATER USE AND DISCHARGE RATES FOR PRECIPITATION AND FILTRATION OF PHOTOGRAPHIC SOLUTIONS

(1/troy ounce of silver precipitated)

Plant Code	Percent Recycle	Production Normalized Water Use	Production Normalized Discharge Flow
30927	0	89.9	89.9
538	0	21.1	21.1
9022(a)	0	13.5	13.5
437	0	6.75	6.75
615(a)	0	1.6	1.6
74	0	1.35	1.35
563	0	NR	NR
567	0	NR	NR
4301	0	NR	NR

NR = data not reported in dcp.

(a) - Plant closed or no longer processing secondary silver.

Table V-5

SECONDARY SILVER SAMPLING DATA
PHOTOGRAPHIC SOLUTIONS
RAW WASTEWATER

Pollutant(a)	Stream Code	Sample Type†	Concentrations (mg/l, except as noted) Source(b)	Day 1	Day 2	Day 3	Average
Toxic Pollutants							
10. 1,2-dichloroethane	61	1		0.068			0.068
15. 1,1,2,3-tetrachloroethane	61	1		<0.029			<0.029
23. chloroform	61	1		0.132			0.132
29. 1,1-dichloroethylene	61	1		0.049			0.049
30. 1,2-trans-dichloroethylene	61	1		0.049			0.049
66. bis(2-ethylhexyl)phthalate	61	1		0.1195			0.1195
67. butyl benzyl phthalate	61	1		0.052			0.052
85. tetrachloromethylene	61	1		<0.025			<0.025
115. arsenic	61	1		0.03			0.03
118. cadmium	61	1		6			6.0
119. chromium	61	1		0.3			0.3
120. copper	61	1		1			1.0
122. lead	61	1		0.5			0.5
123. mercury	61	1		1			1.0
124. nickel	61	1		0.4			0.4
125. selenium	61	1		<0.04			<0.04
126. silver	61	1		<9.2			<9.2
127. thallium	61	1		<0.2			<0.2
128. zinc	61	1		200			200

Table V-5 (Continued)

SECONDARY SILVER SAMPLING DATA
PHOTOGRAPHIC SOLUTIONS
RAW WASTEWATER

Pollutant(a)	Stream Code	Sample Type†	Concentrations (mg/l, except as noted) Source(b)	Day 1	Day 2	Day 3	Average
Nonconventionals							
ammonia	61	1		4,630			4,630
chemical oxygen demand (COD)	61	1		40,700			40,700
chloride	61	1		734			734
total organic carbon (TOC)	61	1		3,085			3,085
Conventionals							
oil and grease	61	1		3			3
total suspended solids (TSS)	61	1		92			92

(a) One sample was analyzed for pesticides: dieldrin, chlordane, 4,4'DDT, 4,4'DDE, endrin, endrin aldehyde, heptachlor, alpha-BHC, beta-BHC and gamma-BHC were detected but below the quantification limit. One sample was analyzed for PCB fractions. PCB-1242, 1254, 1221, 1232, 1248, 1260 and 1016 were detected, but below the quantification limit.

(b) No source water samples were analyzed.

TABLE V-6

WATER USE AND DISCHARGE RATES FOR PRECIPITATION AND FILTRATION OF PHOTOGRAPHIC SOLUTIONS WET AIR POLLUTION CONTROL

(l/troy ounce of silver precipitated)

Plant Code	Percent Recycle	Production Normalized Water Use	Production Normalized Discharge Flow
553	99+	1214.	0.58
74(a)	99+	96,5	0.068
459	100	NR	0
567	68	NR	NR

NR = data not reported in dcp.

(a) - Same scrubber used for film stripping and precipitation of film stripping solutions

(b) - Plant closed

TABLE V-7

WATER USE AND DISCHARGE RATES FOR PRECIPITATION AND FILTRATION OF FILM STRIPPING SOLUTIONS

(l/troy ounce of silver from electrolytic refining)

Plant Code	Percent Recycle	Production Normalized Water Use	Production Normalized Discharge Flow
567(a)	0	1.97	1.97
448(b)	0	1.77	1.77
457	0	1.64	1.64
553	0	0.63	0.63
615(a)	0	0.49	0.49
1104(b)	0	0.44	0.44
460	0	0.31	0.31
460(b)	0	0.06	0.06
65	0	0.28	0.28
1053(b)	0	0.16	0.16
4301	0	0.068	0.068
1084(b)	0	0.035	0.035
578(b)	0	0.024	0.024
1138(b)	0	NR	NR
1071(b)	0	NR	NR
1088(b)	0	NR	NR

NR = data not reported in dcp.

(a) - Plant closed or no longer processes secondary silver

(b) - Date from nonferrous metals manufacturing phase II 1983 dcp

Table V-8

SECONDARY SILVER SAMPLING DATA
NONPHOTOGRAPHIC - MISCELLANEOUS
RAW WASTEWATER

Pollutant(a)	Stream Code	Sample Type	Concentrations (mg/l, except as noted) Source	Day 1	Day 2	Day 3	Average
Toxic Pollutants							
1. acenaphthne	40	6	ND	0.010	ND	ND	0.01
4. benzene	40	2	ND	0.054	*	0.038	0.031
	44	1	ND	*			*
5. carbon tetrachloride	40	2	ND	ND	2.3	1.66	1.98
	44	1	ND	ND			
7. chlorobenzene	40	2	ND	*	*	<0.022	*
	44	1	ND	*			*
11. 1,1,1-trichloroethane	40	2	ND	ND	0.022	ND	0.022
	44	1	ND	ND			
15. 1,1,2,3-tetrachloroethane	40	2	ND	ND	ND	ND	
	44	1	*	<0.038			<0.038
23. chloroform	40	2	0.021	ND	ND	0.312	0.312
	44	1	*	0.109			0.109
38. ethylbenzene	40	2	ND	0.021	*	ND	0.011
	44	1	ND	ND			
47. bromoform	40	2	ND	0.065	ND	ND	0.065
	44	1	ND	ND			
51. chlorodibromomethane	40	2	ND	ND	<0.064	ND	<0.064
	44	1	ND	ND			
66. is(2-ethylhexyl)phthalate	40	2	0.016	0.047			0.047
	44	1	*	0.011			0.011
67. butyl benzyl phthalate	40	2	ND	0.054			0.054
	44	1	*	ND			
68. di-n-butyl phthalate	40	2	*	0.3			0.3
	44	1	*	*			*

Table V-8 (Continued)

SECONDARY SILVER SAMPLING DATA
NONPHOTOGRAPHIC - MISCELLANEOUS
RAW WASTEWATER

Pollutant(a)	Stream Code	Sample Type	Concentrations (mg/l, except as noted) Source	Day 1	Day 2	Day 3	Average
69. di-n-octyl phthalate	40	2	ND	0.055			0.055
	44	1	*	*			*
78. anthracene (b)	40	2	*	<0.014			<0.014
81. phenanthrene (b)	44	1	ND	ND			
84. pyrene	40	2	*	2.15			2.150
	44	1	ND	ND			
85. tetrachloroethylene	40	2	0.011	0.123	0.017	ND	0.07
	44	1	*	<0.046			<0.046
86. toluene	40	2	*	0.057	*	<0.014	0.019
	44	1	ND	0.013			0.013
87. trichloroethylene	40	2	ND	ND	<0.019	ND	<0.019
	44	1	ND	<0.015			<0.015
90. dieldrin	44	1	**	**			**
91. chlordane	44	1	**	**			**
92. 4,4'-DDT	44	1	**	**			**
93. 4,4'-DDE	44	1	ND	**			**
98. endrin	44	1	**	**			**
100. heptechlor	44	1	**	**			**
103. b-BHC-Beta	44	1	**	**			**
107. PCB-1254	44	1	**	**			**
110. PCB-1248	44	1	**	**			**
114. antimony	40	2	<0.1	<0.1			<0.1
115. arsenic	40	2	<0.01	0.05			0.05
	44	1	<0.01	0.05			0.05
117. beryllium	40	2	<0.001	<0.001			<0.001
	44	1	<0.001	0.02			0.02
118. cadmium	40	2	<0.002	1.0			1.0
	44	1	<0.002	80.0			80.0

Table V-8 (Continued)

SECONDARY SILVER SAMPLING DATA
NONPHOTOGRAPHIC - MISCELLANEOUS
RAW WASTEWATER

Pollutant(a)	Stream Code	Sample Type	Concentrations (mg/l, except as noted) Source	Day 1	Day 2	Day 3	Average
119. chromium	40	2	<0.005	2.0			2.0
	44	1	<0.005	20.0			20.0
120. copper	40	2	0.2	70.0			70.0
	44	1	0.04	60.0			60.0
121. cyanide	40	2		0.018	0.132	0.019	0.056
	44	1		0.001			0.001
122. lead	40	2	<0.02	4.0			4.0
	44	1	<0.02	50.0			50.0
123. mercury	40	2	<0.0001	<0.0001			<0.0001
	44	1	0.0002	0.0001			0.0001
124. nickel	40	2	<0.005	30.0			30.0
	44	1	<0.005	800			800
125. selenium	40	2	<0.01	<0.01			<0.01
	44	1	<0.01	<0.01			<0.01
126. silver	40	2	<0.02	0.43			0.43
	44	1	<0.02	4.7			4.7
127. thallium	40	2	<0.1	<0.1			<0.1
	44	1	<0.1	<0.1			<0.1
128. zinc	40	2	<0.06	20.0			20.0
	44	1	<0.06	2,000			2,000
Nonconventionals							
ammonia	40	1		2,180	750	675	1,202
	44	1		9.5			9.5
chemical oxygen demand (COD)	40	2	<5		3,040		3,040
	44	1	<5	231			231

Table V-8 (Continued)

SECONDARY SILVER SAMPLING DATA
NONPHOTOGRAPHIC - MISCELLANEOUS
RAW WASTEWATER

Pollutant(a)	Stream Code	Sample Type	Concentrations (mg/l, except as noted) Source	Day 1	Day 2	Day 3	Average
chloride	44	1	41.0	32,300			32,300
fluoride	40		1.3		1.2		1.2
phenols (total; by 4-AAP method)	40	2		0.017	0.012	0.014	0.014
	44	1		0.044			0.044
total organic carbon (TOC)	40	2	4.0		435.0		435.0
	44	1	5.0	24.0			24.0
Conventionals							
oil and grease	40	1		11	27	13	17.0
	44	1		8			8.0
total suspended solids (TSS)	40	2	14		118		118
	44	1	<1	112			112
pH (standard units)	40	1			2.2	2.3	
	44	1		1.9			

(a) Stream 40 was analyzed for the pesticide fraction, but none were detected above its quantification limit.

(b) Reported together.

TABLE V-9

WATER USE AND DISCHARGE RATES FOR FURNACE WET AIR POLLUTION CONTROL

(l/troy ounce of silver roasted, smelted or dried)

Plant Code	Percent Recycle	Production Normalized Water Use	Production Normalized Discharge Flow
78	99.9	143.7	0.14
553	99.7	49.21	0
65	100	19.85	0
549	100(A)	11.6	0
437	0	9.4	0
9020	0	7.87	7.87
1138(C)	0	0.37	0.37
596	100	NR	NR
441	100	NR	NR
1084	100	NR	NR
459	0	NR	NR
4567	NR	NR	NR

NR = data not reported in dcp.

(a) - Partial evaporation.

(b) - 100 % evaporation.

(c) - Data from nonferrous metals manufacturing phase II 1983 dcp.

TABLE V-10

WATER USE AND DISCHARGE RATES FOR LEACHING

(1/troy ounce of silver produced from leaching)

Plant Code	Percent Recycle	Production Normalized Water Use	Production Normalized Discharge Flow
9022	0	635.2	635.2
9020	0	98.31	98.31
9020(b)	0	2.97	2.97
1145	0	1.56	1.56
1150(b)	0	NR	NR
615(a)	0	0.11	0.11
78	0	0.079	0.079
553	0	0.068	0.068
25	NR	NR	NR
82(a)	NR	NR	NR
567(a)	0	NR	NR
459	NR	NR	NR

NR = data not reported in dcp.

(a) - Partial evaporation.

(b) - 100 % evaporation.

(c) - Data from nonferrous metals manufacturing phase II 1983 dcp.

TABLE V-11

WATER USE AND DISCHARGE RATES FOR LEACHING AND PRECIPITATION OF NONPHOTOGRAPHIC SOLUTIONS WET AIR POLLUTION CONTROL

(l/troy ounce of silver produced from leaching or silver precipitated)

Plant Code	Percent Recycle	Production Normalized Water Use	Production Normalized Discharge Flow
9020	99	984	9.84
74	99+	218	0.12
549	99	90	0.90
83(a)	79.2	54.56	11.3
553	99+	7.0	0.014
78	100	0.078	0
82(a)	97.4	NR	NR
459	100	NR	0
664	100	NR	0
448	NR	NR	NR
567(a)	65	NR	NR
1204(b)	100	13.5	0
578	NR	NR	NR

NR = data not reported in dcp.

(a) - Plant closed or no longer processing secondary silver.

(b) - Data from nonferrous metals manufacturing phase II 1983 dcp.

TABLE V-12

WATER USE AND DISCHARGE RATES FOR PRECIPITATION AND FILTRATION OF NONPHOTOGRAPHIC SOLUTIONS

(l/troy ounce of silver precipitated)

Plant Code	Percent Recycle	Production Normalized Water Use	Production Normalized Discharge Flow
1100	0	109.5	109.5
1092	0	103.3	103.3
9020*	0	78.6	78.6
9020	0	19.9	19.9
1018	0	47.5	47.5
1104	0	17.7	17.7
18	0	12.96	12.96
615(a)	0	7.87	7.87
1128	0	7.53	7.53
1165	0	5.16	5.16
549	0	2.7	2.7
1164	0	2.1	2.1
448	0	1.77	1.77
1029	0	1.23	1.23
1023	0	1.0	1.0
74	0	0.90	0.90
1053(a)	0	0.65	0.65
1167(a)	0	0.52	0.52
4640(a)	0	0.5	0.5
460	0	0.42	0.42
1072	0	0.37	0.37
578	0	0.19	0.19
1204	0	0.183	0.183
1063	0	0.13	0.13
1117	0	0.098	0.098

NR = data not reported in dcp.

(a) - Data from nonferrous metals manufacturing phase II 1983 dcp.

(b) - Plant colsed or no longer processes secondary silver.

Table V-13

SECONDARY SILVER SAMPLING DATA
NONPHOTOGRAPHIC - TREATMENT PLANT SAMPLES - PLANT A

Pollutant	Stream Code	Sample Type	Concentrations (mg/l, except as noted) Source	Day 1	Day 2	Day 3	Average
Toxic Pollutants							
4. benzene	41	2	ND	0.014	ND	ND	0.014
6. carbon tetrachloride	41	2	ND	0.394	0.305	0.401	0.367
15. 1,1,2,3-tetrachloroethane	41	2	ND	ND	0.025	ND	0.025
23. chloroform	41	2	0.021	0.04	0.305	ND	0.173
38. ethylbenzene	41	2	ND	0.012	ND	*	0.006
39. fluoranthene	41	7	*	0.198			0.198
47. bromoform	41	2	ND	ND	0.013	ND	0.013
48. dichlorobromomethane	41	2	ND	2.8	2.4	1.58	2.26
51. chlorodibromomethane	41	2	ND	<0.047	ND	ND	<0.047
66. bis(2-ethylhexyl)phthalate	41	7	0.016	0.022			0.022
67. butyl benzyl phthalate	41	7	ND	0.038			0.038
68. di-n-butyl phthalate	41	7	*	0.082			0.082
69. di-n-octyl phthalate	41	7	ND	0.069			0.069
84. pyrene	41	7	*	0.179			0.179
85. tetrachloroethylene	41	2	0.011	0.017	*	*	0.006
87. trichloroethylene	41	2	ND	<0.014	ND	ND	<0.014
114. antimony	41	7	<0.1	1.5			1.5

Table V-13 (Continued)

SECONDARY SILVER SAMPLING DATA
NONPHOTOGRAPHIC - TREATMENT PLANT SAMPLES - PLANT A

Pollutant	Stream Code	Sample Type	Concentrations (mg/l, except as noted) Source	Day 1	Day 2	Day 3	Average
15. arsenic	41	7	<0.01	1.26			1.26
21. cyanide	41	7		0.020	0.075	0.053	0.049
26. silver	41	7	<0.02	6.9			6.9
Nonconventionals							
ammonia	41	1		2,200	2,080	1,600	1,960
chemical oxygen demand (COD)	41	7	<5		556		556
fluoride	41	7	1.3		2.4		2.4
phenols (total; by 4-AAP method)	41	2		0.008	0.023	0.018	0.016
total organic carbon (TOC)	41	7	4		97		97
Conventionals							
oil and grease	41	1		82	5	10	32
total suspended solids (TSS)	41	7	14		3,140		3,140
pH (standard units)	41	1		7.3	8.1	8.7	

Table V-14

SECONDARY SILVER SAMPLING DATA
NONPHOTOGRAPHIC - TREATMENT PLANT SAMPLES - PLANT B

Pollutant	Stream Code	Sample Type	Concentrations (mg/l, except as noted) Source	Day 1	Day 2	Day 3	Average
Toxic Pollutants							
6. carbon tetrachloride	45	1	ND	0.019			0.019
66. bis(2-ethylhexyl) phthalate	45	2	*	0.03			0.03
118. cadmium	45	2	<0.002	0.1			0.1
119. chromium	45	2	<0.005	<0.05			<0.05
120. copper	45	2	0.04	0.6			0.6
121. cyanide	45	2		0.001			0.001
122. lead	45	2	<0.02	<0.2			<0.2
123. mercury	45	2	<0.0002	0.0001			0.0001
124. nickel	45	2	<0.005	<0.05			<0.05
128. zinc	45	2	<0.06	1			1
Nonconventionals							
ammonia	45	1		0.49			0.49
chemical oxygen demand (COD)	45	1	<5	<5			<5.0
chloride	45	1	41	669			669
phenols (total; by by 4-AAP method)	45	1		0.011			0.011
total organic carbon (TOC)	45	1	5	<1			<1.0

Table V-14 (Continued)

SECONDARY SILVER SAMPLING DATA
NONPHOTOGRAPHIC - TREATMENT PLANT SAMPLES - PLANT B

			Concentrations (mg/l, except as noted)				
Pollutant	Stream Code	Sample Type	Source	Day 1	Day 2	Day 3	Average
Conventionals							
oil and grease	45	1		10			10
total suspended solids (TSS)	45	1	<1	10			10
pH (standard units)	45	1		9.9			

Table V-15

SECONDARY SILVER SAMPLING DATA
PHOTOGRAPHIC - TREATMENT PLANT SAMPLE - PLANT C

Pollutant	Stream Code	Sample Type	Source	Concentrations (mg/l, except as noted) Day 1	Day 2	Day 3	Average
Toxic Pollutants							
4. benzene	13	1		0.06			0.06
	15	1		*	3.2	ND	1.6
	17	1		0.03			0.03
10. 1,2-dichloroethane	13	1		0.126			0.126
	15	1		0.044	ND	0.05	0.047
	17	1		0.26			0.26
23. chloroform	13	1		0.404			0.404
	15	1		0.076	0.07	0.032	0.0593
	17	1		3.18			3.18
29. 1,1-dichloroethylene	13	1		0.101			0.101
	15	1		0.013	ND	ND	0.013
	17	1		3.418			3.418
38. ethylbenzene	13	1		0.014			0.014
	15	1		ND	0.036	0.05	0.043
	17	1		ND			
44. methylene chloride	13	1		0.876			0.876
	15	1		0.086	ND	ND	0.086
	17	1		0.89			0.89
85. tetrachloromethylene	13	1		0.012			0.012
	15	1		ND	ND	ND	
	17	1		0.041			0.041

Table V-15 (Continued)

SECONDARY SILVER SAMPLING DATA
PHOTOGRAPHIC - TREATMENT PLANT SAMPLE - PLANT C

Pollutant	Stream Code	Sample Type	Concentrations (mg/l, except as noted) Source	Day 1	Day 2	Day 3	Average
86. toluene	13	1		0.019			0.019
	15	1		*	ND	ND	*
	17	1		ND			
87. trichloro-ethylene	13	1		0.334			0.334
	15	1		0.047	ND	ND	0.047
	17	1		0.19			0.19
114. antimony	15	1		0.45			0.45
	17	1		ND			
115. arsenic	15	1		0.7			0.7
	17	1		ND			
117. beryllium	15	1		<0.02			<0.02
	17	1		ND			
118. cadmium	15	1		3			3
	17	1		ND			
119. chromium	15	1		8			8
	17	1		ND			
120. copper	15	1		1			1
	17	1		ND			

Table V-15 (Continued)

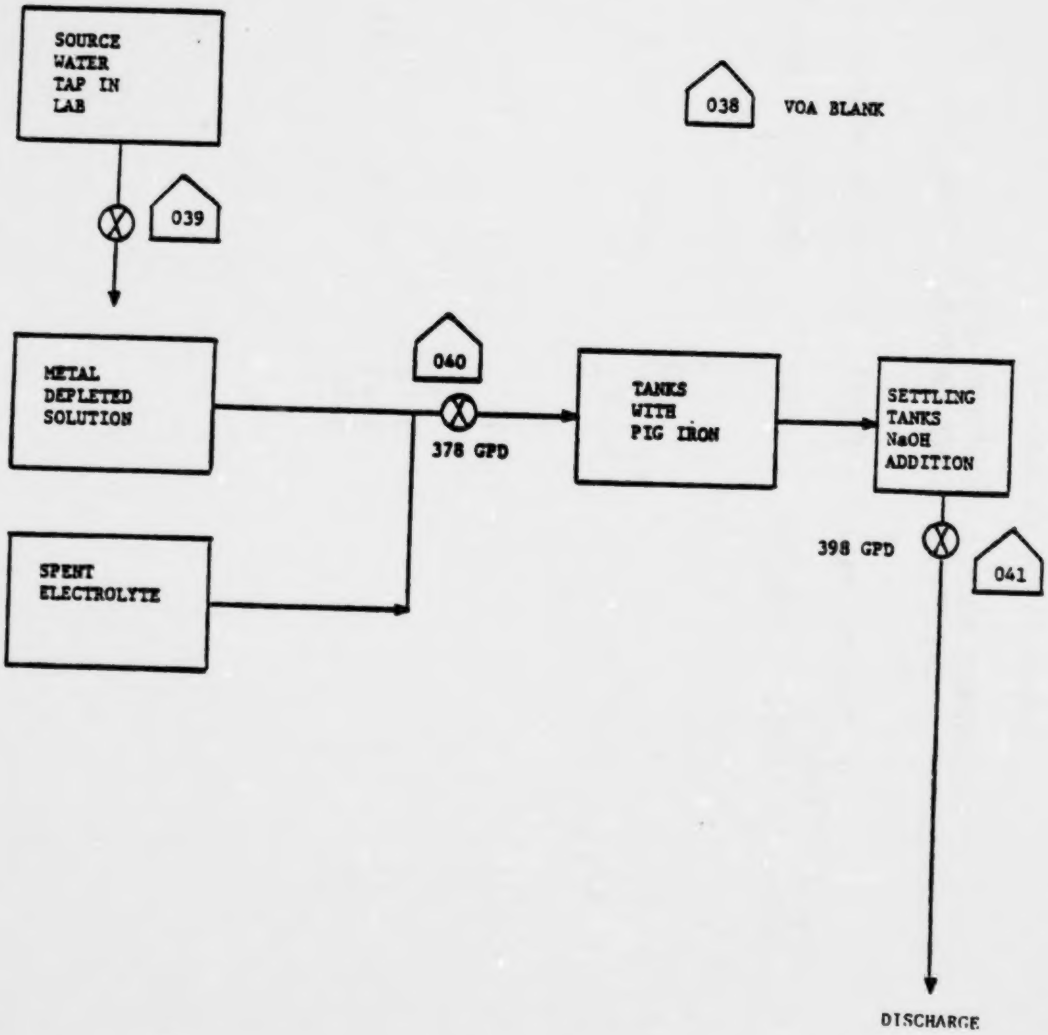
SECONDARY SILVER SAMPLING DATA
PHOTOGRAPHIC - TREATMENT PLANT SAMPLE - PLANT C

Pollutant	Stream Code	Sample Type	Source	Concentrations (mg/l, except as noted) Day 1	Day 2	Day 3	Average
121. cyanide	13	1		2.19			2.19
	15	1		1.29	1.62	2.04	1.65
	17	1		0.098			0.098
122. lead	15	1		3			3
	17	1		ND			
123. mercury	13	1		0.0032			0.0032
	15	1		0.0016			0.0016
	17	1		ND			
1 nickel	15	1		4			4
	17	1		ND			
12 selenium	15	1		0.4			0.4
	17	1		ND			
126. silver	13	1		1			1
	15	1		1			1
127. thallium	13	1		0.65			0.65
	15	1		0.2			0.2
128. zinc	15	1		5			5
	17	1		ND			

Table V-15 (Continued)

SECONDARY SILVER SAMPLING DATA
PHOTOGRAPHIC - TREATMENT PLANT SAMPLE - PLANT C

			Concentrations (mg/l, except as noted)				
Pollutant	Stream Code	Sample Type	Source	Day 1	Day 2	Day 3	Average
Nonconventionals							
phenols (total; by 4-AAP method)	13	1		0.421			0.421
	15	1		26.5	26.8	20.3	24.5
	17	1		51.3			51.3
CONVENTIONALS							
oil and grease	15	1		50	51	195	99
	17	1		21			21
pH (standard units)	13	1		7.14			
	15	1		8.55	7.16	6.97	
	17	1		6.68			


SOURCE WATER TAP IN LAB
039
038
VOA BLANK
METAL DEPLETED SOLUTION
040
378 GPD
TANKS WITH PIG IRON
SETTLING TANKS NaOH ADDITION
SPENT ELECTROLYTE
398 GPD
041
DISCHARGE

igure V-1
SAMPLING SITES AT SECONDARY SILVER PLANT A

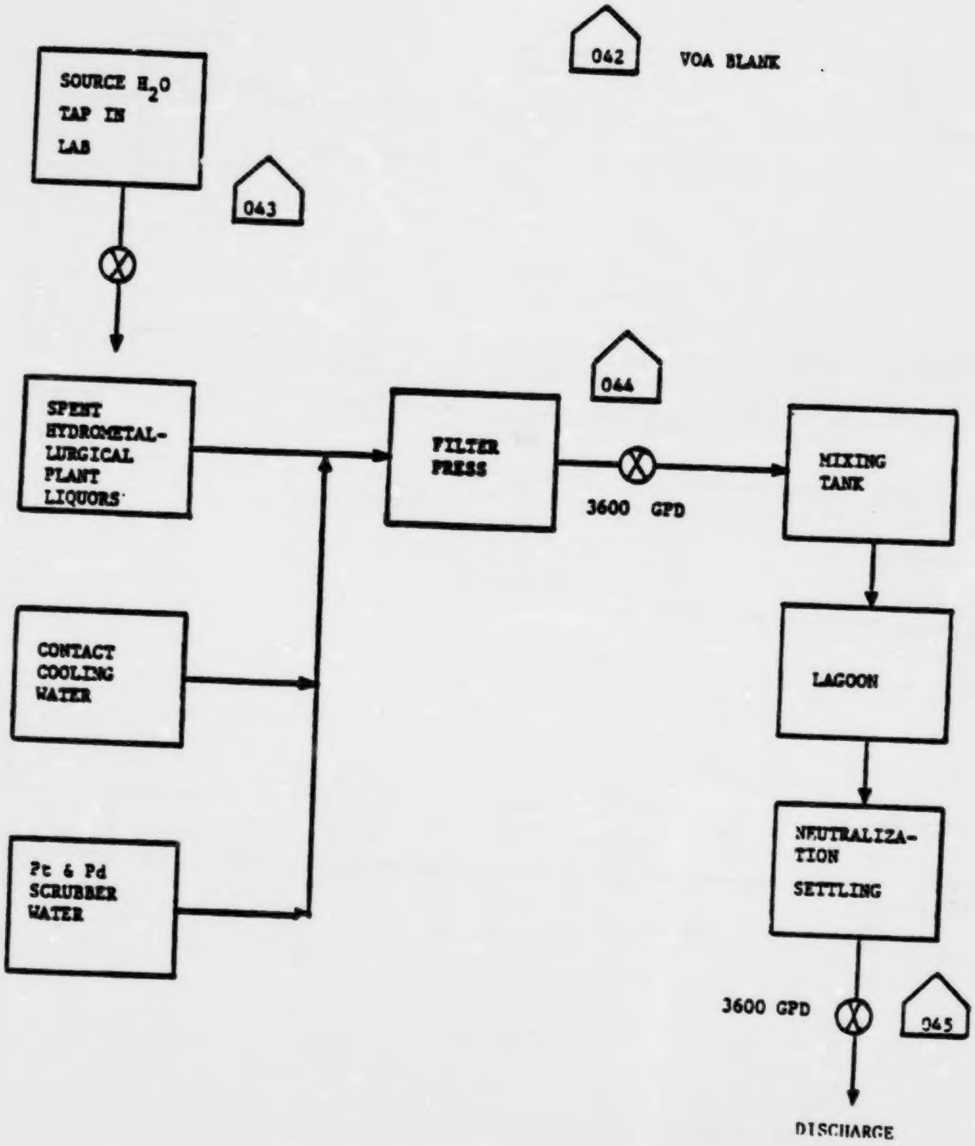

042
VOA BLANK
SOURCE H_2O TAP IN LAB
043
SPENT HYDROMETAL-LURGICAL PLANT LIQUORS
CONTACT COOLING WATER
Pt & Pd SCRUBBER WATER
FILTER PRESS
044
3600 GPD
MIXING TANK
LAGOON
NEUTRALIZA-TION SETTLING
3600 GPD
045
DISCHARGE

Figure V-2
SAMPLING SITES AT SECONDARY SILVER PLANT B

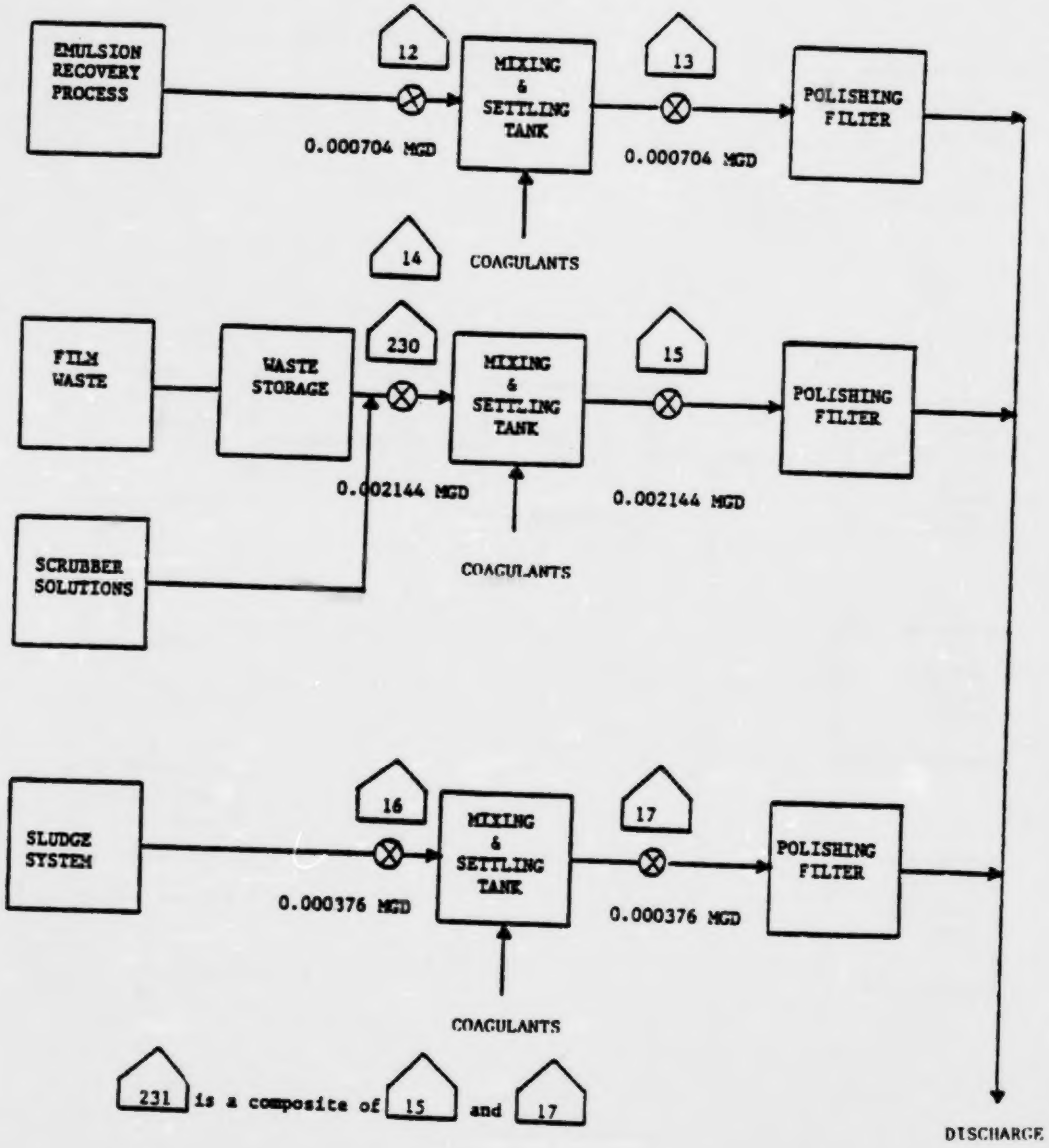

EMULSION RECOVERY PROCESS
12
MIXING & SETTLING TANK
13
POLISHING FILTER
0.000704 MGD
0.000704 MGD
14
COAGULANTS
FILM WASTE
WASTE STORAGE
230
MIXING & SETTLING TANK
15
POLISHING FILTER
0.002144 MGD
0.002144 MGD
SCRUBBER SOLUTIONS
COAGULANTS
SLUDGE SYSTEM
16
MIXING & SETTLING TANK
17
POLISHING FILTER
0.000376 MGD
0.000376 MGD
COAGULANTS
231 is a composite of 15 and 17
DISCHARGE

Figure V-3
SAMPLING SITES AT SECONDARY SILVER PLANT C

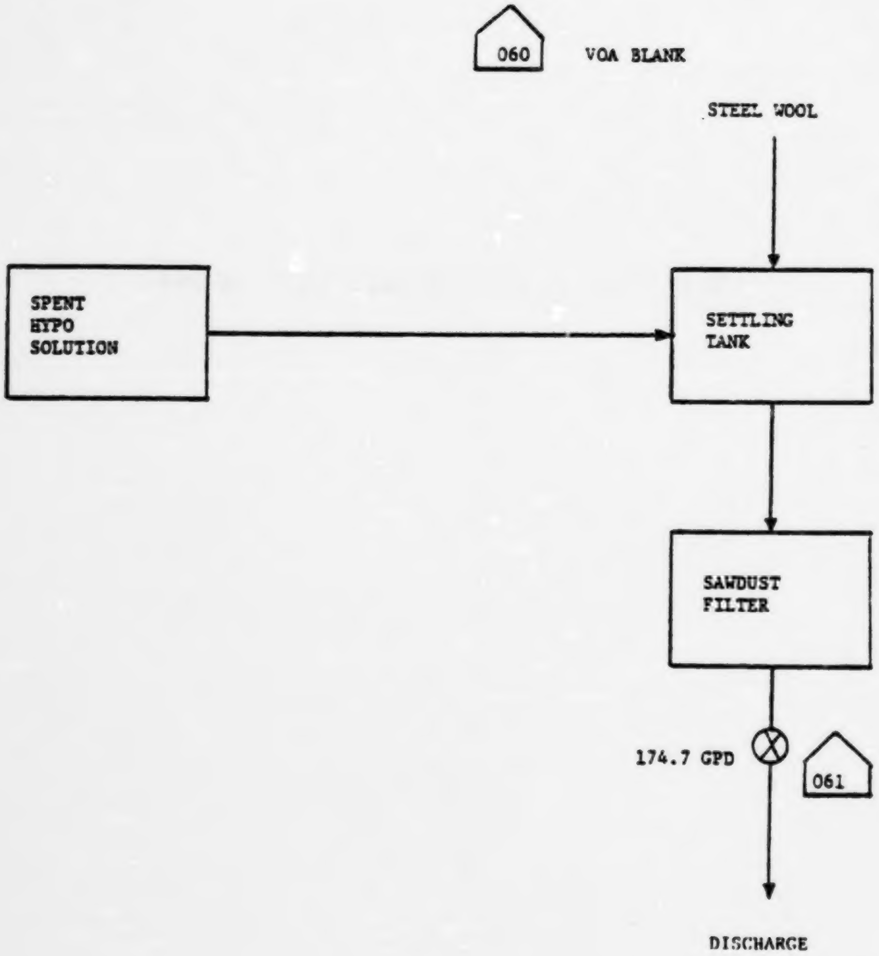

060
VOA BLANK
STEEL WOOL
SPENT HYPO SOLUTION
SETTLING TANK
SAWDUST FILTER
174.7 GPD
061
DISCHARGE

Figure V-4
SAMPLING SITES AT SECONDARY SILVER PLANT D

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SECTION VI

SELECTION OF POLLUTANT PARAMETERS

This section examines chemical analysis data presented in Section V and discusses the selection or exclusion of pollutants for potential limitation.

The discussion that follows describes the analysis that was performed to select or exclude pollutants for further consideration for limitations and standards. Pollutants will be considered for limitation if they are present in concentrations treatable by the technologies considered in this analysis. The treatable concentrations used for the toxic metals were the long-term performance values achievable by lime precipitation, sedimentation, and filtration. The treatable concentrations used for the toxic organics were the long-term values achievable by carbon adsorption.

After proposal, the Agency re-evaluated the treatment performance of activated carbon adsorption to control toxic organic pollutants. The treatment performance for the acid extractable, base-neutral extractable, and volatile organic pollutants has been set equal to the analytical quantification limit of 0.010 mg/l. The analytical quantification limit for pesticides and total phenols (by 4-AAP method) is 0.005 mg/l, which is below the 0.010 mg/l accepted for the other toxic organics. However, to be consistent, the treatment performance of 0.010 mg/l is used for pesticides and total phenols. The 0.010 mg/l concentration is achievable, assuming enough carbon is used in the column and a suitable contact time is allowed. The frequency of occurrence for 36 of the toxic pollutants has been redetermined based on the revised treatment performance value. As a result, the following pollutants, which were not selected at proposal, have been selected for further consideration for limitation:

11. 1,1,1-trichloroethane
30. 1,2-trans-dichloroethylene
38. ethylbenzene
84. pyrene
85. tetrachloroethylene
86. toluene

The selection of these pollutants is discussed in greater detail below.

This study examined samples from the secondary silver subcategory for three conventional pollutant parameters (oil and grease, total suspended solids, and pH) and six nonconventional pollutant parameters (ammonia, chemical oxygen demand, chloride, fluoride, total organic carbon, and total phenols).

CONVENTIONAL AND NONCONVENTIONAL POLLUTANT PARAMETERS SELECTED

The conventional and nonconventional pollutants and pollutant parameters selected for consideration for limitation in this subcategory are:

ammonia
phenols (total; by 4-AAP method)
total suspended solids (TSS)
pH

Ammonia was found in all four samples analyzed in concentrations ranging from 675 to 4,630 mg/l. All of the values recorded are well above the treatable concentration of 32.2 mg/l, attainable by the available treatment technology. Therefore, ammonia is selected for consideration for limitation.

Total phenols are detected in all eight samples analyzed. All eight samples contained phenols in concentrations above the treatable concentration of 0.010 mg/l. Concentrations for the samples ranged from 0.012 to 62.5 mg/l. Therefore, total phenols are also selected for consideration for limitation.

Total suspended solids (TSS) concentrations ranging from 92 to 3,664 mg/l were observed in the five samples analyzed for this study. All five samples exhibited concentrations above the treatable concentration attainable by the identified treatment technology. Furthermore, most of the specific methods for removing toxic metals do so by precipitation, and the resulting toxic metals precipitates should not be discharged. Meeting a limitation on TSS also aids in removal of precipitated toxic metals. For these reasons, total suspended solids is considered for limitation in this subcategory.

The pH values observed in four of seven samples were outside the 6.0 to 10.0 range considered desirable for discharge to receiving waters. Four pH values ranged from 1.1 to 2.95. The remaining three samples ranged from 5.9 to 8.4. Effective removal of toxic metals by chemical precipitation requires careful control of pH. Therefore, pH is considered for limitation in this subcategory.

TOXIC PRIORITY POLLUTANTS

The frequency of occurrence of the toxic pollutants in the wastewater samples taken is presented in Table VI-1 (page 2758). These data provide the basis for the categorization of specific pollutants, as discussed below. Table VI-1 is based on the raw wastewater data from streams 12, 14, 16, 40, 61, and 230 (see Section V). Treatment plant samples were not considered in the frequency count. Raw waste stream 44 was not used in the count because it contained gold, platinum, and palladium processing wastewater in addition to silver processing wastewater.

TOXIC POLLUTANTS NEVER DETECTED

The toxic pollutants listed in Table VI-2 (page 2762) were not detected in any wastewater samples from this subcategory; therefore, they are not selected for consideration in establishing limitations.

TOXIC POLLUTANTS NEVER FOUND ABOVE THEIR ANALYTICAL QUANTIFICATION LIMIT

The toxic pollutants listed below were never found above their analytical quantification concentration in any wastewater samples from this subcategory; therefore, they are not selected for consideration in establishing limitations.

7. chlorobenzene
15. 1,1,2,2-tetrachloroethane
51. chlorodibromomethane
78. anthracene (a)
81. phenanthrene (a)
90. dieldrin
91. chlordane
92. 4,4'-DDT
93. 4,4'-DDE
98. endrin
99. endrin aldehyde
100. heptachlor
102. alpha-BHC
103. beta-BHC
104. gamma-BHC
113. toxaphene
116. asbestos

(a) Reported together.

TOXIC POLLUTANTS PRESENT BELOW CONCENTRATIONS ACHIEVABLE BY TREATMENT

The pollutant listed below is not selected for consideration in establishing limitations because it was not found in any wastewater samples from this subcategory above concentrations considered achievable by existing or available treatment technologies.

Acenaphthene was detected in only one of nine samples analyzed. That sample contained 0.010 mg/l, which is the treatable concentration. Since the pollutant was not detected above the concentration attainable by identified treatment technology, acenaphthene is not considered for limitation.

TOXIC POLLUTANTS DETECTED IN A SMALL NUMBER OF SOURCES

The following pollutants were not selected for limitation on the basis that they were detectable in the effluent from only a small number of sources within the subcategory and are uniquely related to only those sources:

23. chloroform

44. methylene chloride
47. bromoform
66. bis(2-ethylhexyl) phthalate
67. butyl benzyl phthalate
68. di-n-butyl phthalate
69. di-n-octyl phthalate
70. diethyl phthalate
106. PCB-1242 (b)
107. PCB-1254 (b)
108. PCB-1221 (b)
109. PCB-1232 (c)
110. PCB-1248 (c)
111. PCB-1260 (c)
112. PCB-1016 (c)
123. mercury

(b),(c) Reported together, as a combined value

Although these pollutants were not selected for consideration in establishing nationwide limitations, it may be appropriate, on a case-by-case basis, for the local permitter to specify effluent limitations.

Chloroform was found at concentrations ranging from 0.109 to 1.31 mg/l in five of nine samples. The achievable concentration treatment for chloroform is 0.010 mg/l. Chloroform cannot be traced to specific materials or processes associated with the secondary silver subcategory; however, it is a common laboratory solvent and the high concentrations found could be attributed to sample contamination. The presence of chloroform in the blank samples taken attest to this possibility, particularly since the pollutant was not detected in four samples. The results cannot be generalized as characteristic of the subcategory. All 25 of the secondary silver plants reporting the presence or absence of toxic pollutants indicated in the dcp that this pollutant was either known or believed to be absent from their wastewater. Therefore, chloroform is not considered for limitation.

Methylene chloride was measured at a concentration above its treatable concentration in three of nine samples, with values of 0.67, 3.10, and 3.32 mg/l. The treatable concentration is 0.010 mg/l. All three treatable samples were from the same plant. This pollutant is not attributable to specific materials or processes associated with the secondary silver subcategory, but is a common solvent used in analytical laboratories. All 25 of the secondary silver plants reporting the presence or absence of toxic pollutants indicated in the dcp that this pollutant was either known or believed to be absent from their wastewater. Because methylene chloride was not detected in six of nine samples, as well as the high probability of sample contamination, this pollutant is not considered for limitation.

Bromoform was not detected in eight of nine samples, but was found above its treatable concentration in one sample. The 0.065 mg/l found is greater than the 0.01 mg/l treatable concentration.

All 25 of the secondary silver plants reporting the presence or absence of toxic pollutants indicated in the dcp that this pollutant was either known or believed to be absent from their wastewater. Since bromoform is present at only one source, bromoform is assumed to be unique to that source and not considered for limitation.

Bis(2-ethylhexyl) phthalate was found above its treatable concentration of 0.010 mg/l in four of five samples. The concentrations ranged from 0.011 to 0.119 mg/l. This pollutant is not associated with specific processes used in the secondary silver subcategory, but is commonly used as a plasticizer in laboratory and field sampling equipment. All 25 of the secondary silver plants reporting the presence or absence of toxic pollutants indicated in the dcp that this pollutant was either known or believed to be absent from their wastewater. Since the presence of this pollutant may be attributed to sample contamination, bis(2-ethylhexyl) phthalate is not considered for limitation.

Butyl benzyl phthalate was measured in two of five samples at concentrations of 0.052 and 0.054 mg/l. The treatable concentration for this pollutant is 0.010 mg/l. This pollutant is used as a plasticizer in laboratory and field sampling equipment. Since it was not detected in three of five samples, the measurements may be regarded as specific to the site and not characteristic of the subcategory as a whole. All 25 of the secondary silver plants reporting the presence or absence of toxic pollutants indicated in the dcp that this pollutant was either known or believed to be absent from their wastewater. Therefore, butyl benzyl phthalate is not considered for limitation.

Di-n-butyl phthalate was found above its treatable concentration (0.010 mg/l) in four of five samples analyzed. However, this compound is a plasticizer used in many products found in manufacturing plants; it is not associated with specific processes used in this subcategory. All 25 of the secondary silver plants reporting the presence or absence of toxic pollutants indicated in the dcp that this pollutant was either known or believed to be absent from their wastewater. Therefore, di-n-butyl phthalate is not considered for limitation.

Di-n-octyl phthalate was measured above its treatable concentration (0.010 mg/l) in three of five samples analyzed. However, this compound is a plasticizer used in many products found in manufacturing plants; it is not associated with specific processes in this subcategory. All 25 of the secondary silver plants reporting the presence or absence of toxic pollutants indicated in the dcp that this pollutant was either known or believed to be absent from their wastewater. Therefore, di-n-octyl phthalate is not considered for limitation.

Diethyl phthalate was detected above its treatable concentration (0.010 mg/l) in one of five samples analyzed. However, this compound is a plasticizer used in many products found in manufacturing plants; it is not associated with specific processes in this subcategory. All 25 of the secondary silver plants reporting the presence or absence of toxic pollutants indicated in the dcp that this pollutant was either known or believed to be absent from their wastewater. Because of the site-specificity of the one result, diethyl phthalate is not considered for limitation.

The seven toxic pollutant PCBs (polychlorinated biphenyls) are not clearly separated by the analytical protocol used in this study; thus, they are reported in two groups. The first group contains PCB-1242, PCB-1254, and PCB-1221; the second contains PCB-1232, PCB-1248, PCB-1260, and PCB-1016. Both groups were found in one of five samples at the same plant. The concentration for each group was 0.012 mg/l, which slightly exceeds the treatable concentration of 0.010 mg/l. All 25 of the secondary silver plants reporting the presence or absence of toxic pollutants indicated in the dcp that this pollutant was either known or believed to be absent from their wastewater. Since these pollutants were found in only one plant, they are assumed to be unique to that source and are not considered for limitation.

Mercury was measured above its treatable concentration (0.036 mg/l) in one of four samples. Even though found at 1.0 mg/l, this pollutant is not attributable to specific materials and processes in this subcategory. Also, 22 of the 25 secondary silver plants reporting the presence or absence of toxic pollutants indicated in the dcp that mercury was known to be absent or believed to be absent from their wastewater. Since it was found in only one plant, mercury is not considered for limitation.

TOXIC POLLUTANTS SELECTED FOR CONSIDERATION IN ESTABLISHING LIMITATIONS

The pollutants listed below are selected for further consideration in establishing limitations and standards for this subcategory.

4. benzene
6. carbon tetrachloride
10. 1,2-dichloroethane
11. 1,1,1-trichloroethane
29. 1,1-dichloroethylene
30. 1,2-trans-dichloroethylene
38. ethylbenzene
84. pyrene
85. tetrachloroethylene
86. toluene
87. trichloroethylene
114. antimony
115. arsenic
118. cadmium

119. chromium
120. copper
121. cyanide
122. lead
124. nickel
125. selenium
126. silver
127. thallium
128. zinc

Benzene was detected above its treatable concentration (0.010 mg/l) in seven of nine samples. The concentrations ranged from 0.017 to 2.05 mg/l. Since benzene was present in concentrations exceeding the concentration achievable by identified treatment technology, it is selected for consideration for limitation.

Carbon tetrachloride was found above its treatable concentration (0.010 mg/l) in three of nine samples. Concentrations ranged from 0.07 to 2.3 mg/l. Since carbon tetrachloride was present in concentrations exceeding the concentration achievable by identified treatment technology, it is selected for consideration for limitation.

1,1,1-Trichloroethane was detected at two plants in two of nine samples, both at concentrations of 0.022 mg/l. The treatable concentration is 0.010 mg/l for this pollutant. Therefore, 1,1,1-trichlorethane is selected for consideration for limitation.

1,2-Dichloroethane was detected above its quantification limit in four of nine samples in two plants. Two samples, with concentrations of 0.58 and 0.156 mg/l, were above the concentration considered attainable by treatment (0.010 mg/l). Since 1,2-dichloroethane was present in concentrations exceeding the concentration achievable by identified treatment technology, it is selected for consideration for limitation.

1,1-Dichloroethylene was measured above its treatable concentration (0.010 mg/l) in three of nine samples in two plants, with concentrations of 0.049, 0.33, and 6.1 mg/l. Since 1,1-dichloroethylene was present in concentrations exceeding the concentration achievable by identified treatment technology, it is selected for consideration for limitation.

1,2-Trans-dichloroethylene was detected in one of nine samples with a concentration of 0.049 mg/l. This value is above the treatable concentration (0.010 mg/l). The raw wastewater stream containing this pollutant was sampled at only one plant. Therefore, the presence of this pollutant cannot be regarded as site-specific. For these reasons, 1,2-trans-dichloroethylene is selected for consideration for limitation.

Ethylbenzene was found in six of nine samples. Only three samples contained this pollutant above its concentration considered attainable by treatment (0.010 mg/l). These values ranged from 0.016 to 0.021 mg/l. Also, it was detected at two of three plants. Therefore, ethylbenzene is selected for consideration for limitation.

Pyrene was found in one of five samples at a concentration of 2.15 mg/l, which is much greater than its treatable concentration (0.010 mg/l). The raw wastewater stream containing this pollutant was sampled at only one plant. Therefore, the presence of this pollutant cannot be regarded as site-specific and is selected for consideration for limitation.

Tetrachloroethylene was measured above concentrations regarded achievable by identified treatment technology (0.010 mg/l) in four of nine streams. The values ranged from 0.017 mg/l to 0.123 mg/l. Tetrachloroethylene was detected below its quantification limit in two other samples. These samples represent five different wastewater streams at three plants. For these reasons, this pollutant is selected for consideration for limitation.

Toluene was detected in seven of nine samples representing four raw wastewater streams from three plants. Five of its measured concentrations ranged from 0.013 mg/l to 0.05 mg/l, which is above the concentration considered attainable by available treatment for this pollutant (0.010 mg/l). Therefore, toluene is selected for consideration for limitation.

Trichloroethylene was detected above its treatable concentration (0.010 mg/l) in three of nine samples. The concentrations ranged from 0.473 to 0.93 mg/l. Since trichloroethylene was present in concentrations exceeding the concentration achievable by identified treatment technology, it is selected for consideration for limitation.

Antimony was found above its treatable concentration (0.47 mg/l) in three of five samples. The concentrations ranged from 0.7 to 12.0 mg/l. Since antimony was present in concentrations exceeding the concentration achievable by identified treatment technology, it is selected for consideration for limitation.

Arsenic was measured above its quantification limit in all five samples analyzed. Two of the five samples contained this pollutant above the treatable concentration (0.34 mg/l), with concentrations of 1.9 and 2.2 mg/l. Since arsenic was present in concentrations exceeding the concentration achievable by identified treatment technology, it is selected for consideration for limitation.

Chromium was found above its treatable concentration (0.07 mg/l) in all five samples analyzed. The concentrations ranged from 0.3 to 100 mg/l. Since chromium was present in concentrations exceeding the concentration achievable by identified treatment technology, it is selected for consideration for limitation.

Copper was detected above its treatable concentration (0.39 mg/l) in all five samples analyzed. The concentrations ranged from

0.72 to 70.0 mg/l. Since copper was present in concentrations exceeding the concentration achievable by identified treatment technology, it is selected for consideration for limitation.

Cyanide was measured above its treatable concentration (0.047 mg/l) in six of nine samples from four of the five waste streams. The concentrations ranged from 0.132 to 5.95 mg/l, in two plants (one photographic and one nonphotographic). Since cyanide was present in concentrations exceeding the concentration achievable by identified treatment technology, it is selected for consideration for limitation.

Lead was found above its treatable concentration (0.08 mg/l) in all five samples analyzed. The concentrations ranged from 0.5 to 9.0 mg/l. Since lead was present in concentrations exceeding the concentration achievable by identified treatment technology, it is selected for consideration for limitation.

Nickel was measured above its treatable concentration (0.22 mg/l) in four of five samples. The concentrations ranged from 0.4 to 30.0 mg/l. Since nickel was present in concentrations exceeding the concentration achievable by identified treatment technology, it is selected for consideration for limitation.

Selenium was found above its treatable concentration (0.20 mg/l) in three of five samples. The concentrations ranged from 0.25 to 0.9 mg/l. Since selenium was present in concentrations exceeding the concentration achievable by identified treatment technology, it is selected for consideration for limitation.

Silver was detected above its quantification limit in three of five samples analyzed. Concentrations ranged from 0.07 to 5.0 mg/l. Three samples contained silver at concentrations above the concentration considered attainable by treatment (0.07 mg/l). Since silver was present in concentrations exceeding the concentration achievable by identified treatment technology, it is selected for consideration for limitation.

Thallium was found above its quantification limit in two of the five samples analyzed for this pollutant. One of the five samples contained thallium at a concentration of 0.4 mg/l, above the treatable concentration (0.34 mg/l) for this pollutant. Since thallium was present in concentrations exceeding the concentration achievable by identified treatment technology, it is selected for consideration for limitation.

Zinc was measured above its treatable concentration (0.23 mg/l) in all five samples analyzed. The concentrations ranged from 4.0 to 2,000 mg/l. Since zinc was present in concentrations exceeding the concentration attainable by identified treatment technology, it is selected for consideration for limitation.

Table VI-1

FREQUENCY OF OCCURRENCE OF TOXIC POLLUTANTS
SECONDARY SILVER
RAW WASTEWATER

Pollutant	Analytical Quantification Concentration (mg/l)(a)	Treatable Concentration (mg/l)(b)	Number of Streams Analyzed	Number of Samples Analyzed	ND	Detected Below Quantification Concentration	Detected Below Treatable Concentration	Detected Above Treatable concentration
1. acenaphthene	0.010	0.010	5	5	4		1	
2. acrolein	0.010	0.010	5	9	9			
3. acrylonitrile	0.010	0.010	5	9	9			
4. benzene	0.010	0.010	5	9	1	1		7
5. benzidine	0.010	0.010	5	5	5			
6. carbon tetrachloride	0.010	0.010	5	9	6			3
7. chlorobenzene	0.010	0.010	5	9	6	3		
8. 1,2,4-trichlorobenzene	0.010	0.010	5	5	5			
9. hexachlorobenzene	0.010	0.010	5	5	5			
10. 1,2-dichloroethane	0.010	0.010	5	9	5			4
11. 1,1,1-trichloroethane	0.010	0.010	5	9	7			2
12. hexachloroethane	0.010	0.010	5	5	5			
13. 1,1-dichloroethane	0.010	0.010	5	9	9			
14. 1,1,2-trichloroethane	0.010	0.010	5	9	9			
15. 1,1,2,2-tetrachloroethane	0.010	0.010	5	9	8	1		
16. chloroethane	0.010	0.010	5	9	9			
17. bis(chloromethyl) ether	0.010	0.010	5	9	9			
18. bis(2-chloroethyl) ether	0.010	0.010	5	5	5			
19. 2-chloroethyl vinyl ether	0.010	0.010	5	9	9			
20. 2-chloronaphthalene	0.010	0.010	5	5	5			
21. 2,4,6-trichlorophenol	0.010	0.010	5	3	3			
22. parachlorometa cresol	0.010	0.010	5	3	3			
23. chloroform	0.010	0.010	5	9	4			5
24. 2-chlorophenol	0.010	0.010	5	3	3			
25. 1,2-dichlorobenzene	0.010	0.010	5	5	5			
26. 1,3-dichlorobenzene	0.010	0.010	5	5	5			
27. 1,4-dichlorobenzene	0.010	0.010	5	5	5			
28. 3,3'-dichlorobenzidine	0.010	0.010	5	5	5			
29. 1,1-dichloroethylene	0.010	0.010	5	9	6			3
30. 1,2-trans-dichloroethylene	0.010	0.010	5	9	8			1
31. 2,4-dichlorophenol	0.010	0.010	5	3	3			
32. 1,2-dichloropropane	0.010	0.010	5	9	9			
33. 1,3-dichloropropylene	0.010	0.010	5	9	9			
34. 2,4-dimethylphenol	0.010	0.010	5	3	3			
35. 2,4-dinitrotoluene	0.010	0.010	5	5	5			
36. 2,6-dinitrotoluene	0.010	0.010	5	5	5			
37. 1,2-diphenylhydrazine	0.010	0.010	5	5	5			

Table VI-1 (Continued)

FREQUENCY OF OCCURRENCE OF TOXIC POLLUTANTS
SECONDARY SILVER
RAW WASTEWATER

Pollutant	Analytical Quantification Concentration (mg/l)(a)	Treatable Concentration (mg/l)(b)	Number of Streams Analyzed	Number of Samples Analyzed	ND	Detected Below Quantification Concentration	Detected Below Treatable Concentration	Detected Above Treatable Concentration
38. ethylbenzene	0.010	0.010	5	9	3	3		3
39. fluoranthene	0.010	0.010	5	5	5			
40. 4-chlorophenyl phenyl ether	0.010	0.010	5	5	5			
41. 4-bromophenyl phenyl ether	0.010	0.010	5	5	5			
42. bis(2-chloroisopropyl) ether	0.010	0.010	5	5	5			
43. bis(2-chloroethoxy) methane	0.010	0.010	5	5	5			
44. methylene chloride	0.010	0.010	5	9	6			3
45. methyl chloride	0.010	0.010	5	9	9			
46. methyl bromide	0.010	0.010	5	9	9			
47. bromoform	0.010	0.010	5	9	8			1
48. dichlorobromomethane	0.010	0.010	5	9	9			
49. trichlorofluoromethane	0.010	0.010	5	9	9			
50. dichlorodifluoromethane	0.010	0.010	5	9	9			
51. chlorodibromomethane	0.010	0.010	5	9	8	1		
52. hexachlorobutadiene	0.010	0.010	5	5	5			
53. hexachlorocyclopentadiene	0.010	0.010	5	5	5			
54. isophorone	0.010	0.010	5	5	5			
55. naphthalene	0.010	0.010	5	5	5			
56. nitrobenzene	0.010	0.010	5	5	5			
57. 2-nitrophenol	0.010	0.010	5	3	3			
58. 4-nitrophenol	0.010	0.010	5	3	3			
59. 2,4-dinitrophenol	0.010	0.010	5	3	3			
60. 4,6-dinitro-o-cresol	0.010	0.010	5	3	3			
61. N-nitrosodimethylamine	0.010	0.010	5	5	5			
62. N-nitrosodiphenylamine	0.010	0.010	5	5	5			
63. N-nitrosodi-n-propylamine	0.010	0.010	5	5	5			
64. pentachlorophenol	0.010	0.010	5	3	3			
65. phenol	0.010	0.010	5	3	3			
66. bis(2-ethylhexyl) phthalate	0.010	0.010	5	5		1		4
67. butyl benzyl phthalate	0.010	0.010	5	5	3			2
68. di-n-butyl phthalate	0.010	0.010	5	5	1			4
69. di-n-octyl phthalate	0.010	0.010	5	5	2			3
70. diethyl phthalate	0.010	0.010	5	5	4			1
71. dimethyl phthalate	0.010	0.010	5	5	5			
72. benzo(a)anthracene	0.010	0.010	5	5	5			
73. benzo(a)pyrene	0.010	0.010	5	5	5			
74. 3,4-benzofluoranthene	0.010	0.010	5	5	5			

Table VI-1 (Continued)

FREQUENCY OF OCCURRENCE OF TOXIC POLLUTANTS
SECONDARY SILVER
RAW WASTEWATER

Pollutant	Analytical Quantification Concentration (mg/1)(a)	Treatable Concentration (mg/1)(b)	Number of Streams Analyzed	Number of Samples Analyzed	ND	Detected Below Quantification Concentration	Detected Below Treatable Concentration	Detected Above Treatable Concentration
75. benzo(k)fluoranthene	0.010	0.010	5	5	5			
76. chrysene	0.010	0.010	5	5	5			
77. acenaphthylene	0.010	0.010	5	5	5			
78. anthracene (c)	0.010	0.010	5	5	4	1		
79. benzo(ghi)perylene	0.010	0.010	5	5	5			
80. fluorene	0.010	0.010	5	5	5			
81. phenanthrene (c)	0.010	0.010	5	5	4	1		
82. dibenzo(a,h)anthracene	0.010	0.010	5	5	5			
83. indeno(1,2,3-cd)pyrene	0.010	0.010	5	5	5			
84. pyrene	0.010	0.010	5	5	4			1
85. tetrachloroethylene	0.010	0.010	5	9	3	2		4
86. toluene	0.010	0.010	5	9	2	2		5
87. trichloroethylene	0.010	0.010	5	9	5	1		3
88. vinyl chloride	0.010	0.010	5	9	9			
89. aldrin	0.005	0.010	5	5	5			
90. dieldrin	0.005	0.010	5	5	3	2		
91. chlordane	0.005	0.010	5	5	2	3		
92. 4,4'-DDT	0.005	0.010	5	5	3	2		
93. 4,4'-DDE	0.005	0.010	5	5	3	2		
94. 4,4'-DDD	0.005	0.010	5	5	5			
95. alpha-endosulfan	0.005	0.010	5	5	5			
96. beta-endosulfan	0.005	0.010	5	5	5			
97. endosulfan sulfate	0.005	0.010	5	5	5			
98. endrin	0.005	0.010	5	5	3	2		
99. endrin aldehyde	0.005	0.010	5	5	4	1		
100. heptachlor	0.005	0.010	5	5	3	2		
101. heptachlor epoxide	0.005	0.010	5	5	5			
102. alpha-BHC	0.005	0.010	5	5	4	1		
103. beta-BHC	0.005	0.010	5	5	3	2		
104. gamma-BHC	0.005	0.010	5	5	4	1		
105. delta-BHC	0.005	0.010	5	5	5			
106. PCB-1242 (d)	0.005	0.010	5	5	4			1
107. PCB-1254 (d)	0.005							
108. PCB-1221 (d)	0.005							
109. PCB-1232 (e)	0.005	0.010	5	5		4		1
110. PCB-1248 (e)	0.005							
111. PCB-1260 (e)	0.005							
112. PCB-1016 (e)	0.005							

Table VI-1 (Continued)

FREQUENCY OF OCCURRENCE OF TOXIC POLLUTANTS
SECONDARY SILVER
RAW WASTEWATER

Pollutant	Analytical Quantification Concentration (mg/l)(a)	Treatable Concentration (mg/l)(b)	Number of Streams Analyzed	Number of Samples Analyzed	ND	Detected Below Quantification Concentration	Detected Below Treatable Concentration	Detected Above Treatable Concentration
113. toxaphene	0.005	0.010	5	5	3	2		
114. antimony	0.100	0.47	5	5	2			3
115. arsenic	0.010	0.34	5	5			3	2
116. asbestos	10 MFL	10 MFL	2	2	1	1		
117. beryllium	0.010	0.20	5	5	5			
118. cadmium	0.002	0.49	5	5				5
119. chromium	0.005	0.07	5	5				5
120. copper	0.009	0.39	5	5				5
121. cyanide	0.02 (f)	0.047	5	9	1	2		6
122. lead	0.020	0.08	5	5				5
123. mercury	0.0001	0.036	4	4	1		2	1
124. nickel	0.005	0.22	5	5	1			4
125. selenium	0.01	0.20	5	5	2			3
126. silver	0.02	0.07	5	5	2			3
127. thallium	0.100	0.34	5	5	3		1	1
128. zinc	0.050	0.23	5	5				5
129. 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD)		Not Analyzed	.					

(a) Analytical quantification concentration was reported with the data (see Section V).

) Treatable concentrations are based on performance of lime precipitation, sedimentation, and filtration for toxic metal pollutants and activated carbon adsorption for toxic organic pollutants.

.(d),(e) Reported together.

(f) Analytical quantification concentration for EPA Method 335.2, Total Cyanide Methods for Chemical Analysis of Water and Wastes, EPA-600/4-79-020, March 1979.

TABLE VI-2

TOXIC POLLUTANTS NEVER DETECTED

2. acrolein
3. acrylonitrile
5. benzidine
8. 1,2,4-trichlorobenzene
9. hexachlorobenzene
12. hexachloroethane
13. 1,1-dichloroethane
14. 1,1,2-trichloroethane
16. chloroethane
17. DELETED
18. bis(2-chloroethyl) ether
19. 2-chloroethyl vinyl ether
20. 2-chloronaphthalene
21. 2,4,6-trichlorophenol
22. parachlorometa cresol
24. 2-chlorophenol
25. 1,2-dichlorobenzene
26. 1,3-dichlorobenzene
27. 1,4-dichlorobenzene
28. 3,3'-dichlorobenzidine
31. 2,4-dichlorophenol
32. 1,2-dichloropropane
33. 1,3-dichloropropylene
34. 2,4-dimethylphenol
35. 2,4-dinitrotoluene
36. 2,6-dinitrotoluene
37. 1,2-diphenylhydrazine
39. fluoranthene
40. 4-chlorophenyl phenyl ether
41. 4-bromophenyl phenyl ether
42. bis(2-chloroisopropyl) ether
43. bis(2-chloroethoxy) methane
45. methyl chloride
46. methyl bromide
48. dichlorobromomethane
49. DELETED
50. DELETED
52. hexachlorobutadiene
53. hexachlorocyclopentadiene
54. isophorone
55. naphthalene
56. nitrobenzene
57. 2-nitrophenol
58. 4-nitrophenol
59. 2,4-dinitrophenol
60. 4,6-dinitro-o-cresol

TABLE VI-2 (Continued)

TOXIC POLLUTANTS NEVER DETECTED

61. N-nitrosodimethylamine
62. N-nitrosodiphenylamine
63. N-nitrosodi-n-propylamine
64. pentachlorophenol
65. phenol
71. dimethyl phthalate
72. benzo(a)anthracene
73. benzo(a)pyrene
74. 3,4-benzofluoranthene
75. benzo(k)fluoranthene
76. chrysene
77. acenaphthylene
79. benzo(ghi)perylene
80. fluorene
82. dibenzo(a,h)anthracene
83. indeno(1,2,3-cd)pyrene
88. vinyl chloride
89. aldrin
94. 4,4'-DDD
95. alpha-endosulfan
96. beta-endosulfan
97. endosulfan sulfate
101. heptachlor epoxide
105. delta-BHC
117. beryllium
129. 2,3,7,8-tetrachlorodibenzo-p-dioxin

SECTION VII

CONTROL AND TREATMENT TECHNOLOGIES

The preceding sections of this supplement discussed the sources, flows, and characteristics of the wastewaters from secondary silver plants. This section summarizes the description of these wastewaters and indicates the level of treatment which is currently practiced by the secondary silver subcategory for each waste stream.

CURRENT CONTROL AND TREATMENT PRACTICES

This section presents a summary of the control and treatment technologies that are currently being applied to each of the sources generating wastewater in this subcategory. As discussed in Section V, wastewater associated with the secondary silver subcategory is characterized by the presence of the toxic metal pollutants and suspended solids. (The raw (untreated) wastewater data for specific sources as well as combined waste streams are presented in Section V.) Generally, these pollutants are present in each of the waste streams at concentrations above treatable concentrations, so these waste streams are commonly combined for treatment to reduce the concentrations of these pollutants. Construction of one wastewater treatment system for combined treatment allows plants to take advantage of economies of scale and, in some instances, to combine streams of differing alkalinity to reduce treatment chemical requirements. Twenty-two plants in this subcategory currently have combined wastewater treatment systems, five have lime precipitation and sedimentation, two have lime precipitation, sedimentation and filtration, and nine have lime precipitation and filtration. As such, three options have been selected for consideration for BPT, BAT, BDT, and pretreatment in this subcategory, based on combined treatment of these compatible waste streams.

FILM STRIPPING

The film base (residue) resulting from the stripping of photographic film can be screened and rinsed, producing wastewater. One of the three plants with this process reported an effluent, none of which is recycled. As discussed in Section V, this wastewater should contain treatable concentrations of toxic metals, oil and grease, cyanide, phenolics, and total suspended solids. The one plant treats film stripping wastewater with sedimentation, pH adjustment, a trickling filter, followed by an activated sludge system.

FILM STRIPPING WET AIR POLLUTION CONTROL AND PRECIPITATION AND FILTRATION OF FILM STRIPPING SOLUTIONS WET AIR POLLUTION CONTROL

One of the three plants engaged in film stripping and precipitation of film stripping solutions uses a wet scrubber to

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control air emissions. Toxic organics, toxic metals, phenolics, total suspended solids, and cyanide should be present at treatable concentrations. This plant practices 99+ percent recycle of film stripping scrubber water. Treatment of the wastewater consists of neutralization, flocculation, and sedimentation, followed by polishing filtration.

PRECIPITATION AND FILTRATION OF FILM STRIPPING SOLUTIONS

Depleted silver solutions from film stripping must be discarded after precipitation. Four of five plants discharge this wastewater. Toxic organics, toxic metals, total suspended solids, phenolics, and cyanide should be present at treatable concentrations. No plants reported recycling this wastewater Treatment at one plant consists of settling, pH adjustment, trickling filtration, and an activated sludge system. Another plant treats by neutralization with caustic soda or acid, flocculation by polymer addition, and settling followed by polishing filtration. Two plants discharge into municipal sewer lines without treatment.

PRECIPITATION AND FILTRATION OF PHOTOGRAPHIC SOLUTIONS

Silver-free solutions are usually discarded after precipitation. All seven plants precipitating photographic solutions produce wastewater from this process. Treatable concentrations of ammonia and toxic metals characterize this wastewater. Most suspended solids will have been removed with the silver precipitate during filtration. There are no plants that recycle this wastewater. A number of treatment methods are applied before this wastewater is discharged. They are:

1. Neutralization with limestone - one plant,
2. Neutralization with caustic and filtration - one plant,
3. Neutralization with caustic, sedimentation, and filtration - one plant,
4. Settling, pH adjustment, trickling filter, and activated sludge system - one plant,
5. No treatment - two plants, and
6. Contractor disposal - one plant.

PRECIPITATION AND FILTRATION OF PHOTOGRAPHIC SOLUTIONS WET AIR POLLUTION CONTROL

Three plants use wet scrubbers on precipitation and filtration processes. The wastewater characteristics are similar to scrubber wastewater from film stripping precipitation because of the similar materials and processes used. Toxic organics, metals, cyanide, and total suspended solids should be present in this wastewater at treatable concentrations. One plant practices complete recycle of silver solution scrubber water. The three others practice partial recycle of the scrubber liquor (99+ percent). The following treatment schemes are currently in use in the subcategory:

1. 100 percent evaporation - one plant,
2. Neutralization with caustic, polymer addition, sedimentation, and polishing filtration - one plant,
3. No treatment - one plant.

ELECTROLYTIC REFINING

Wastewater discharges from electrolytic refining consist of spent electrolyte solution and water from washing the recovered silver. Of the 15 plants having an electrolytic refining process, 13 discharge wastewater. This wastewater should contain treatable concentrations of carbon tetrachloride, pyrene, bromoform, benzene, and tetrachloroethylene. Toxic metals, ammonia, cyanide, and total suspended solids are present above treatable concentrations. One plant reported recycling the spent electrolyte to a precipitation process. The following treatment methods are currently practiced:

1. No treatment - three plants,
2. Neutralization with caustic - one plant,
3. Precipitation with sodium bicarbonate and sedimentation - one plant,
4. Contractor disposal - two plants,
5. Neutralization with caustic and sedimentation - one plant,
6. Neutralization with caustic, flocculation with alum, and sedimentation - one plant,
7. Zinc cementation to recover precious metals, neutralization with caustic, polymer addition, and pressure filtration - one plant,
8. Iron cementation to recover precious metals and pH adjustment (chemical unspecified) - one plant,
9. Neutralization with caustic and filtration - one plant,
10. Iron cementation to recover precious metals, neutralization with caustic and sedimentation - one plant.

FURNACE WET AIR POLLUTION CONTROL

Air emission sources in secondary silver furnace operations are incinerators, roasting and drying furnaces, and melting furnaces. Nineteen secondary silver producers control air emissions, using various methods. These are:

1. Baghouse - seven plants,
2. Dry electrostatic precipitator - three plants,
3. Afterburner - four plants,
4. Wet scrubber - eight plants (includes Venturi, wet electrostatic precipitator, and spray type scrubbers),
5. Wet scrubber and baghouse - two plants,
6. Wet scrubber, afterburner and baghouse - two plants,
7. Afterburner and baghouse - one plant.

Total suspended solids should be present at treatable concentrations in the wastewater produced by wet air pollution control. Six plants producing this wastewater practice complete recycle or evaporation. Two others practice partial recycle (>99 percent). Treatment methods used are:

1. No treatment - five plants,
2. 100 percent evaporation - one plant,
3. Neutralization and precipitation with caustic, sodium sulfide or calcium chloride, flocculation with polymer, and sedimentation - one plant,
4. Contractor disposal - one plant.
5. Neutralization with caustic, filtration, evaporation and complete recycle - one plant.
6. Complete recycle-mechanism not reported - two plants.

LEACHING

Of the 13 nonphotographic silver plants that leach, 11 produce wastewater. This wastewater should contain treatable concentrations of toxic organics and metals, ammonia, cyanide, phenolics, and suspended solids. One plant recovers precious metals from the waste by electrolysis. Wastewater treatment methods used are:

1. Neutralization with caustic, filtration, and ion exchange - one plant,
2. Neutralization with lime, polymer addition, and sedimentation - one plant,
3. Contractor disposal - two plants,
4. Neutralization and precipitation with caustic, sodium sulfide, or calcium chloride, followed by flocculation with polymer and sedimentation - one plant,
5. Evaporation - one plant,
6. No treatment - one plant.

LEACHING WET AIR POLLUTION CONTROL AND PRECIPITATION OF NONPHOTOGRAPHIC SOLUTIONS WET AIR POLLUTION CONTROL

All 13 plants that leach nonphotographic materials reported air emissions controls. Devices commonly used are packed bed, spray tower, and venturi scrubbers. This wastewater contains treatable concentrations of toxic metals and total suspended solids. Three plants practice complete recycle of the scrubber water. Seven other plants recycle from 65 to 99+ percent. Treatment methods used consist of:

1. Neutralization and precipitation with caustic, sodium sulfide, or calcium chloride, followed by flocculation with polymer and sedimentation - one plant,
2. Neutralization with caustic, polymer addition, sedimentation, and polishing filtration - one plant,
3. Neutralization with caustic, polymer addition, and sedimentation - one plant,
4. Neutralization in a limestone bed - one plant,
5. Iron cementation and pH adjustment (chemical unspecified) - one plant,

6. Neutralization with caustic - one plant,
7. Neutralization with caustic and filtration - one plant,
8. Evaporation - one plant,
9. Contractor disposal - one plant,
10. No treatment - three plants.

PRECIPITATION AND FILTRATION OF NONPHOTOGRAPHIC SOLUTIONS

All 27 of the silver plants with this process produce wastewater. This wastewater should contain toxic organics, toxic metals, ammonia, cyanide, phenolics, and total suspended solids. No plants reported recycling this waste stream. Treatment methods for this wastewater consist of:

1. Neutralization and precipitation with caustic, sodium sulfide, or calcium chloride, followed by flocculation with polymer and sedimentation - one plant,
2. Neutralization with caustic, polymer addition, sedimentation, and polishing filtration - one plant,
3. Neutralization with caustic and sedimentation - two plants,
4. Neutralization with caustic, polymer addition, and sedimentation - one plant,
5. Neutralization with caustic and filtration - one plant,
6. Contractor disposal - three plants,
7. Neutralization with caustic - four plants,
8. Lime precipitation, polymer addition, and sedimentation - two plants,
9. Zinc cementation, caustic neutralization, polymer addition, sedimentation, and pressure filtration - one plant,
10. Chlorine addition and neutralization with caustic - one plant
11. pH adjustment (chemical unspecified) - one plant,
12. Neutralization with limestone - two plants,
13. Chlorination, lime precipitation, sodium sulfide precipitation, and sedimentation - one plant,
14. Caustic and ammonia addition, sedimentation, and filtration - one plant,
15. Sodium hydrosulfite and caustic addition, recycle of sludge to process, ion exchange, pH adjustment with sulfuric acid - one plant,
16. Neutralization with caustic, flocculation with alum, and sedimentation - one plant,
17. Iron cementation and pH adjustment (chemical unspecified) - one plant,
18. Iron cementation, neutralization with caustic, and sedimentation - one plant,
19. No treatment - two plants.

FLOOR AND EQUIPMENT WASHDOWN

Many plants wash equipment and floors to recover silver values that may be contained in accidental leaks and spills of process solutions. Data on treatment of floor wash water were not generally available in the data collection portfolios. However, some plants practice cementation to recover the precious metals before discharging the wastewater to POTW or central treatment. This wastewater contains treatable concentration of toxic metals and total suspended solids. As described above, central treatment usually consists of neutralization with lime or caustic and sedimentation. Eleven plants use filtration either after sedimentation or as a solids removal step to replace sedimentation.

CONTROL AND TREATMENT OPTIONS

Based on an examination of the wastewater sampling data, three control and treatment technologies that effectively control the pollutants found in secondary silver wastewaters were evaluated after proposal. These technology options are discussed below. The effectiveness of these technologies is presented in Section VII of the General Development Document.

Other treatment technologies included activated alumina adsorption (Option D) and reverse osmosis (Option F). Although these technologies are theoretically applicable to wastewaters generated in the secondary silver subcategory, they were not selected for evaluation because they are not demonstrated in the nonferrous metals manufacturing category, nor are they clearly transferable.

OPTION A

Option A for the secondary silver subcategory requires treatment technologies to reduce pollutant mass. The Option A treatment scheme consists of ammonia steam stripping preliminary treatment applied to precipitation and filtration of photographic solutions. Preliminary treatment is followed by lime and settle (chemical precipitation and sedimentation) applied to the combined stream steam stripper effluent and the combined stream of all other wastewater. Complete recycle of treated floor and equipment washdown wastewater is also included. Chemical precipitation is used to remove metals by the addition of lime followed by gravity sedimentation. Suspended solids are also removed from the process.

OPTION B

Option B for the secondary silver subcategory consists of the ammonia steam stripping, lime precipitation, and sedimentation technology considered in Option A plus control technologies to reduce the discharge of wastewater volume. Complete recycle of treated floor and equipment washdown wastewater is also included. Water recycle and reuse of scrubber water is the principal control mechanism for additional flow reduction.

OPTION C

Option C for the secondary silver subcategory consists of the ammonia steam stripping, in-process flow reduction, lime precipitation, and sedimentation technology considered in Option B plus multimedia filtration technology added at the end of the Option B treatment scheme. Complete recycle of treated floor and equipment washdown wastewater is also included. Multimedia filtration is used to remove suspended solids, including precipitates of metals, beyond the concentration attainable by gravity sedimentation. The filter suggested is of the gravity, mixed media type, although other forms of filters such as rapid sand filters or pressure filters would perform satisfactorily. The addition of filters also provides consistent removal during periods in which there are rapid increases in flows or loadings of pollutants to the treatment system.

An additional treatment technology was considered prior to proposing effluent limitations for this subcategory as discussed below. Activated carbon adsorption was rejected because it is not necessary since toxic organic pollutants are not selected for limitation in this subcategory. (Refer to discussion of regulated pollutant parameters in Section X.)

OPTION E

Option E for the secondary silver subcategory consisted of the ammonia steam stripping, in-process flow reduction, lime precipitation, sedimentation, and multimedia filtration technology considered in Option C with the addition of granular activated carbon technology at the end of the Option C treatment scheme. The activated carbon process is utilized to control the discharge of toxic organics.

SECTION VIII

COSTS, ENERGY, AND NONWATER QUALITY ASPECTS

This section describes the method used to develop the costs associated with the control and treatment technologies discussed in Section VII for wastewaters from secondary silver plants. The energy requirements of the considered options as well as solid waste and air pollution aspects are also discussed.

As discussed in Section VII, three control and treatment options have been developed for the secondary silver subcategory. The options are summarized below and schematically presented in Figures X-1 through X-3 (pages 2818 - 2820).

OPTION A

Option A requires preliminary ammonia steam stripping treatment, and end-of-pipe technology consisting of lime precipitation, sedimentation, and complete recycle of treated floor and equipment washdown wastewater. The stream that will require ammonia steam stripping preliminary treatment is precipitation and filtration of photographic solutions wastewater.

OPTION B

Option B requires in-process flow reduction measures, preliminary ammonia steam stripping treatment, and end-of-pipe treatment technology consisting of lime precipitation, sedimentation, and complete recycle of floor and equipment washdown wastewater. The in-process flow reduction measures consist of the recycle of wet air pollution control water through holding tanks.

OPTION C

Option C requires the in-process flow reduction measures of Option B, preliminary ammonia steam stripping treatment, and end-of-pipe treatment technology consisting of lime precipitation, sedimentation, complete recycle of treated floor and equipment washdown wastewater, and multimedia filtration.

A detailed discussion of the methodology used to develop the compliance costs is presented in Section VIII of the General Development Document. Plant-by-plant compliance costs have been estimated for the nonferrous metals manufacturing category and are presented in the administrative record supporting this regulation. A comparison of the costs developed for proposal and the revised costs for the final regulation are presented in Tables VIII-1 and VIII-2 (page 2776) for the direct and indirect dischargers, respectively.

Each of the major assumptions used to develop compliance costs is presented in Section VIII of Vol. I. However, each subcategory

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contains a unique set of waste streams requiring certain subcategory-specific assumptions to develop compliance costs. Six major assumptions are discussed briefly below.

(1) Since 23 of the plants whose compliance costs were estimated overlap with other nonferrous manufacturing subcategories or categories, costs are apportioned to each subcategory on a flow-weighted basis.

(2) Although a discharge allowance for floor wash is not necessary, a flow of 1 liter of floor wash per troy ounce is used for cost estimation purposes for each plant on the basis of total production of all precious metals (including silver) that results in precipitation and filtration wastewater. Since acceptable floor wash water may be obtained from recycling treated wastewater, costs are estimated for a holding tank after chemical precipitation and settling to recycle water for floor wash use under all options.

(3) Sodium hydroxide addition was used throughout the secondary silver subcategory in estimating costs for chemical precipitation since it is likely that most plants will recycle treatment plant sludges for additional metal recovery.

(4) When a plant reported recycle of treatment plant sludges, capital and annual costs for sludge handling (vacuum filtration and contract hauling) are not included. Where the sludge disposal method is reported as contract hauling, or is unknown, contract hauling costs are included assuming nonhazardous disposal.

(5) Recycle of air pollution control scrubber liquor is based on recycle through holding tanks. Annual costs associated with maintenance and sludge disposal are included in the estimated compliance costs. If a plant currently recycles scrubber liquor, capital costs of the recycle equipment (piping, pumps, and holding tanks) were not included in the compliance costs.

(6) Costs for ammonia removal for streams with flow rates below 50 liters per hour (none of which are air pollution streams) are estimated using an air stripping system. Ammonia steam stripping is not considered feasible due to insufficient hydraulic loading in the stripping column (given the minimum column diameter of 2 feet used in cost estimation).

The chemical precipitation tank is used for the air stripping operation. Chemical precipitation is always operated in the "low flow" batch treatment mode with a five day holdup due to the low flow rate (see the discussion on chemical precipitation in Section VIII of the General Development Document for a description of the "low flow" batch treatment mode). An air sparger is incorporated into the reactor tank. The influent is sparged while the tank fills with wastewater, i.e., over the entire five day holdup period. A hood is placed over the tank to capture any ammonia-laden vapors.

Direct capital costs for the ammonia air stripping system include a blower, a sparger system, and a ventilation hood. Direct annual costs are assumed to consist solely of blower operation and maintenance costs. These are assumed to be 5 percent of the blower capital cost.

NONWATER QUALITY ASPECTS

A general discussion of the nonwater quality aspects of the control and treatment options considered for the nonferrous metals category is contained in Section VIII of the General Development Document. Nonwater quality impacts specific to the secondary silver subcategory including energy requirements, solid waste, and air pollution are discussed below:

ENERGY REQUIREMENTS

The methodology used for determining the energy requirements for the various options is discussed in Section VIII of Vol. I. Energy requirements for the three options considered are estimated at 0.88 mwh/yr, 0.88 mwh/yr, and 0.93 mwh/yr for Options A, B, and C respectively. Option C represents roughly eight percent of a typical plant's electrical usage. It is therefore concluded that the energy requirements of the treatment options considered will have no significant impact on total plant energy consumption.

SOLID WASTES

Sludges associated with the secondary silver subcategory will necessarily contain additional quantities (and concentrations) of toxic metal pollutants. Wastes generated by secondary metals industries can be regulated as hazardous. However, the Agency examined the solid wastes that would be generated at secondary nonferrous metals manufacturing plants by the suggested treatment technologies and believes they are not hazardous wastes under the Agency's regulations implementing Section 3001 of the Resource Conservation and Recovery Act. None of these wastes are listed specifically as hazardous. Nor are they likely to exhibit a characteristic of hazardous waste. This judgment is made based on the recommended technology of lime precipitation, sedimentation, and filtration. By the addition of excess lime during treatment, similar sludges, specifically toxic metal bearing sludges, generated by other industries such as the iron and steel industry, passed the Extraction Procedure (EP) toxicity test. See 40 CFR 8261.24. Thus, the Agency believes that the waste water sludges will similarly not be EP toxic if the recommended technology is applied.

Although it is the Agency's view that solid wastes generated as a result of these guidelines are not expected to be hazardous, generators of these wastes must test the waste to determine if the wastes meet any of the characteristics of hazardous waste (see 40 CFR 262.11).

If these wastes should be identified or are listed as hazardous, they will come within the scope of RCRA's "cradle to grave" hazardous waste management program, requiring regulation from the point of generation to point of final disposition. EPA's generator standards would require generators of hazardous nonferrous metals manufacturing wastes to meet containerization, labeling, recordkeeping, and reporting requirements; if plants dispose of hazardous wastes off-site, they would have to prepare a manifest which would track the movement of the wastes from the generator's premises to a permitted off-site treatment, storage, or disposal facility. See 40 CFR 262.20 45 FR 33142 (May 19, 1980), as amended at 45 FR 86973 (December 31, 1980). The transporter regulations require transporters of hazardous wastes to comply with the manifest system to assure that the wastes are delivered to a permitted facility. See 40 CFR 263.20 45 FR 33151 (May 19, 1980), as amended at 45 FR 86973 (December 31, 1980).

Finally, RCRA regulations establish standards for hazardous waste treatment, storage, and disposal facilities allowed to receive such wastes. See 40 CFR Part 464 46 FR 2802 (January 12, 1981), 47 FR 32274 (July 26, 1982).

Even if these wastes were not identified as hazardous, they still must be disposed of in compliance with the Subtitle D open dumping standards, implementing 4004 of RCRA. See 44 FR 53438 (September 13, 1979). The Agency has calculated as part of the costs for wastewater treatment the cost of hauling and disposing of these wastes. The Agency estimates implementation of lime and settle technology will generate approximately 2,900 tons per year of wastewater treatment sludge. Multimedia filtration technology will not generate any significant amount of sludge over that resulting from lime precipitation.

AIR POLLUTION

There is no reason to believe that any substantial air pollution problem will result from implementation of ammonia steam stripping, chemical precipitation, sedimentation, and multimedia filtration. These technologies transfer pollutants to solid waste and are not likely to transfer pollutants to air.

At three secondary silver plants, streams with treatable concentrations of ammonia having flows less than 50 l/hr were treated with air stripping for design and cost determination. None of the waste streams were air pollution control streams. The air stripping is accomplished by aeration and agitation in the chemical precipitation batch tank, which includes a ventilation hood. Air stripping is not a model treatment technology because it simply transfers the ammonia from one medium to another, whereas steam stripping allows for ammonia recovery, and if desired, reuse. Air stripping was used in costing instead of steam stripping because at such low flow, continuous operation of steam strippers is not possible. Therefore, the treatable concentration for ammonia would be difficult to attain. The Agency does not believe that under these circumstances (low flow, non-air pollution control streams) that air stripping will create an air quality problem.

TABLE VIII-1

COST OF COMPLIANCE FOR THE SECONDARY SILVER SUBCATEGORY DIRECT DISCHARGERS

Option	Proposal		Promulgation	
	Capital Cost	Annual Cost	Capital Cost	Annual Cost
A	169000	357000	110000	309000
B	250000	379000	110000	309000
C	280000	469000	278000	390000

TABLE VIII-2

COST OF COMPLIANCE FOR THE SECONDARY SILVER SUBCATEGORY INDIRECT DISCHARGERS

Option	Proposal		Promulgation	
	Capital Cost	Annual Cost	Capital Cost	Annual Cost
A	1066000	1233000	596000	381000
B	1400000	1302000	577000	385000
C	1549000	1454000	534000	422000

SECTION IX

BEST PRACTICABLE CONTROL TECHNOLOGY CURRENTLY AVAILABLE

This section defines the effluent characteristics attainable through the application of best practicable control technology currently available (BPT). BPT reflects the existing performance by plants of various sizes, ages, and manufacturing processes within the secondary silver subcategory, as well as the established performance of the recommended BPT systems. Particular consideration is given to the treatment already in place at plants within the data base.

The factors considered in identifying BPT include the total cost of applying the technology in relation to the effluent reduction benefits from such application, the age of equipment and facilities involved, the manufacturing processes employed, nonwater quality environmental impacts (including energy requirements), and other factors the Administrator considers appropriate. In general, the BPT level represents the average of the existing performances of plants of various ages, sizes, processes, or other common characteristics. Where existing performance is uniformly inadequate, BPT may be transferred from a different subcategory or category. Limitations based on transfer of technology are supported by a rationale concluding that the technology is, indeed, transferable, and a reasonable prediction that it will be capable of achieving the prescribed effluent limits. BPT focuses on end-of-pipe treatment rather than process changes or internal controls, except where such practices are common within the subcategory.

TECHNICAL APPROACH TO BPT

The Agency studied the nonferrous metals manufacturing category to identify the processes used, the wastewaters generated, and the treatment processes installed. Information was collected from industry using data collection portfolios, and specific plants were sampled and the wastewaters analyzed. Some of the factors which must be considered in establishing effluent limitations based on BPT have already been discussed. The age of equipment and facilities, processes used, and raw materials were taken into account in subcategorization and subdivision and are discussed fully in Section IV. Nonwater quality impacts and energy requirements are considered in Section VIII.

As explained in Section IV, the secondary silver subcategory has been subdivided into 11 potential wastewater sources. Since the water use, discharge rates, and pollutant characteristics of each of these wastewaters is potentially unique, effluent limitations will be developed for each of the 11 subdivisions.

For each of the subdivisions, a specific approach was followed for the development of BPT mass limitations. To account for production and flow variability from plant to plant, a unit of production or production normalizing parameter (PNP) was determined for each waste stream which could then be related to the flow from the process to determine a production normalized flow. Selection of the PNP for each process element is discussed in Section IV. Each process within the subcategory was then analyzed to determine (1) whether or not operations included generated wastewater, (2) specific flow rates generated, and (3) the specific production normalized flows for each process. This analysis is discussed in detail in Section V. Nonprocess wastewater, such as rainfall runoff and noncontact cooling water, is not considered in the analysis.

Normalized flows were analyzed to determine which flow was to be used as part of the basis for BPT mass limitations. The selected flow (sometimes referred to as a BPT regulatory flow or BPT discharge rate) reflects the water use controls which are common practices within the subcategory. The BPT normalized flow is based on the average of all applicable data. Plants with normalized flows above the average may have to implement some method of flow reduction to achieve the BPT limitations. In most cases, this will involve improving housekeeping practices, better maintenance to limit water leakage, or reducing excess flow by turning down a flow valve. It is not believed that these modifications would incur any costs for the plants.

For the development of effluent limitations, mass limitations were calculated for each wastewater source or subdivision. This calculation was made on a stream-by-stream basis, primarily because plants in this category may perform one or more of the operations in various combinations. The mass limitations (milligrams of pollutant per troy ounce of production unit - mg/troy ounce) were calculated by multiplying the BPT normalized flow (l/troy ounce) by the achievable treatment concentrations using the BPT treatment system (mg/l) for each pollutant parameter to be limited under BPT.

The mass limitations which are allowed under BPT for each plant will be the sum of the individual mass loadings for the various wastewater sources which are found at particular plants. Accordingly, all the wastewater generated within a plant may be combined for treatment in a single or common treatment system, but the effluent limitations for these combined wastewaters are based on the various wastewater sources which actually contribute to the combined flow. This method accounts for the variety of combinations of wastewater sources and production processes which may be found at secondary silver plants.

The Agency usually establishes wastewater limitations in terms of mass rather than concentration. This approach prevents the use of dilution as a treatment method (except for controlling pH). The production normalized wastewater flow (l/troy ounce) is a link between the production operations and the effluent limitations. The pollutant discharge attributable to each operation can be calculated from the normalized flow and effluent concentration achievable by the treatment technology and summed to derive an appropriate limitation for each subcategory.

BPT effluent limitations are based on the average of the discharge flow rates for each source; consequently, the treatment technologies which are currently used by the lowest dischargers will be the treatment technologies most likely required to meet BPT guidelines. Section VII discusses the various treatment technologies which are currently in place for each wastewater source. In most cases, the current treatment technologies consist of chemical precipitation and sedimentation (lime and settle technology) and a combination of reuse and recycle to reduce flow. Ammonia steam stripping is added to streams containing treatable concentrations of ammonia.

The overall effectiveness of end-of-pipe treatment for the removal of wastewater pollutants is improved by the application of water flow controls within the process to limit the volume of wastewater requiring treatment. The controls or in-process technologies recommended under BPT include only those measures which are commonly practiced within the subcategory and which reduce flows to meet the production normalized flow for each operation.

INDUSTRY COST AND POLLUTANT REMOVAL ESTIMATES

In balancing costs in relation to effluent removal estimates, EPA considers the volume and nature of existing discharges, the volume and nature of discharges expected after application of BPT, the general environmental effects of the pollutants, and the cost and economic impacts of the required pollution control level. The Act does not require or permit consideration of water quality problems attributable to particular point sources or industries, or water quality improvements in particular water quality bodies. Accordingly, water quality considerations were not the basis for selecting the proposed BPT. See Weyerhaeuser Company v. Costle, 590 F.2d 1011 (D.C. Cir. 1978).

The methodology for calculating pollutant removal estimates and plant compliance costs is discussed in Section X. Table X-2 (page 2819) shows the estimated pollutant removal estimates for each treatment option for direct dischargers. Compliance costs are presented in Table VIII-1 (page 2818) for direct dischargers.

BPT OPTION SELECTION - PROPOSAL

The proposed best practicable technology consisted of chemical precipitation and sedimentation (lime and settle technology) with ammonia steam stripping preliminary treatment of wastewaters containing treatable concentrations of ammonia. The best practicable technology is presented schematically in Figure IX-1 (page 2797) of this supplement.

Ammonia steam stripping is demonstrated in the nonferrous metals manufacturing category. Two plants in the primary columbium-tantalum subcategory and three plants in the primary tungsten subcategory reported steam stripping in-place.

EPA believes that performance data from the iron and steel manufacturing category provide a valid measure of this technology's performance on nonferrous metals manufacturing category wastewater because raw wastewater concentrations of ammonia are of the same order of magnitude in the respective raw wastewater matrices. A detailed discussion of this technology transfer is found in Section VII of Vol. I.

Chemical analysis data were collected of raw waste (treatment influent) and treated waste (treatment effluent) from one coke plant of the iron and steel manufacturing category. A contractor for EPA, using EPA sampling and chemical analysis protocols, collected data paired samples in a two-month period. These data are the data base for determining the effectiveness of ammonia steam stripping technology and are contained within the public record supporting this document. Ammonia treatment at this coke plant consisted of two steam stripping columns in series with steam injected countercurrently to the flow of the wastewater. A lime reactor for pH adjustment separated the two stripping columns.

The raw untreated wastewater samples from the coke facility contained ammonia concentrations of 599, 226, 819, 502, 984, and 797 mg/l. Raw untreated wastewater samples from the secondary silver subcategory contained ammonia concentrations of 1,202 and 4,630 mg/l.

BPT OPTION SELECTION - PROMULGATION

EPA is promulgating BPT limitations for the secondary silver subcategory based on lime precipitation and sedimentation to remove toxic metals, control pH, and remove TSS and pretreatment with steam stripping to reduce ammonia concentrations. Complete recycle of treated floor and equipment washdown wastewater is also included. The end-of-pipe treatment technology basis for the BPT limitations being promulgated is the same as that for the proposed limitations. Lime and settle treatment technology is currently in place at five direct discharging facilities.

The Agency has collected data on secondary precious metals facilities through data collection portfolios (dcp) so that it may propose mass limitations for the secondary precious metals subcategory. Many of the plants in the subcategory overlap with the secondary silver subcategory. Review of these dcp, and the dcp collected only for the secondary silver subcategory, has led the Agency to revise the regulatory flows. Accordingly, the wastewater streams from film stripping wet air pollution control and precipitation and filtration of film stripping solutions wet air pollution control have been combined into one building block. Leaching wet air pollution control and precipitation of nonphotographic solutions wet air pollution control wastewater sources have also been combined into one building block. In addition, the mass limitations proposed for casting contact cooling water and casting wet air pollution control have been eliminated. Analytical data collected at a secondary precious metals plant demonstrate casting contact cooling water is not sufficiently contaminated to warrant treatment. Casting wet air pollution control limitations have been eliminated because the Agency believes this limitation is duplicated by the furnace wet air pollution control limitations (these operations are identical). A flow allowance is not provided for floor and equipment washdown based on reuse of recycled treatment effluent as facility washdown water. In developing compliance cost estimates, the Agency sized treatment equipment to allow for this flow.

The Agency has verified the proposed steam stripping performance values using steam stripping data collected at a zirconium-hafnium plant. Data collected by the plant represent almost two years of daily operations and support the long-term mean and variability used to establish treatment effectiveness.

Several comments were received (although none were from secondary silver plants) stating that ammonia steam stripping performance data transferred from the iron and steel category are not appropriate for the nonferrous metals manufacturing category. Many of the commenters believe plugging of the column due to precipitates will severely affect their ability to achieve the promulgated steam stripping performance values. In developing compliance costs, the Agency designed the steam stripping module to allow for a weekly acid cleaning to reduce plugging problems. Through special information requests, the Agency attempted to gather data at plants which stated they could not achieve the proposed limits. However, very little data were submitted to support their claims or document column performance. Therefore, the Agency has retained the proposed performance, which has been validated with steam stripping data from a zirconium-hafnium facility.

The promulgated BPT will result in the removal of an estimated 30,870 kg of toxic pollutants, 664,000 kg of ammonia, and 7,750 kg of TSS per year from raw discharge levels. The estimated capital investment cost of BPT is $110,000 (March, 1982 dollars) and the estimated annual cost is $309,000 (March, 1982 dollars). These costs represent wastewater treatment equipment not currently in place.

WASTEWATER DISCHARGE RATES

A BPT discharge rate is calculated for each subdivision based on the average of the flows of the existing plants, as determined from analysis of the dcp. The discharge rate is used with the achievable treatment concentration to determine BPT effluent limitations. Since the discharge rate may be different for each wastewater source, separate production normalized discharge rates for each of the 11 wastewater sources are discussed below and summarized in Table IX-1 (page 2789). The discharge rates are normalized on a production basis by relating the amount of wastewater generated to the mass of the intermediate product which is produced by the process associated with the waste stream in question. These production normalizing parameters, or PNPs, are also listed in Table IX-1.

Section V of this supplement further describes the discharge flow rates and presents the water use and discharge flow rates for each plant by subdivision.

COLLECTION OF NEW DATA

In the proposed development document, separate subdivisions were identified for precipitation and filtration of film stripping solutions wet air pollution control, casting contact cooling water, casting wet air pollution control, and precipitation and filtration of nonphotographic solutions wet air pollution control. Based on new data gathered from secondary precious metals dcp and sampling efforts and re-evaluation of existing data, these subdivisions were either combined with other subdivisions or deleted. A subdivision for floor and equipment washdown was added.

Although flow and production data were collected from secondary precious metals dcp in the nonferrous metals manufacturing category, these data were not used to modify the proposed regulatory flow allowances. The new data support the proposed flow allowances and the Agency did not receive any comments suggesting that the allowances should be revised. The new flow data are included in the water use and discharge tables in Section V. Wastewater discharge allowances for the 11 subdivisions of the secondary silver subcategory are discussed below.

The regulatory flow allowance at proposal for casting contact cooling water has been eliminated. Analytical data collected at a secondary precious metals plant demonstrate casting contact cooling water is not sufficiently contaminated to require treatment. However, it is possible that toxic pollutants may be present in larger concentrations at any individual plant than the Agency's sampling data indicate. Therefore, the permitting or controlling authority should check for the presence of toxic pollutants on a case-by-case basis and determine if they require treatment.

FILM STRIPPING

The BPT wastewater discharge rate at proposal for film stripping was 50.35 l/troy ounce of silver produced from film stripping. At proposal, three plants reported wastewater discharges from film stripping, but the dcp data provided by two plants were insufficient to calculate discharge rates. Therefore, the discharge rate from one plant was used.

The BPT wastewater discharge rate is 50.35 l/troy ounce of silver produced from film stripping. The Agency received no new data for this waste stream after proposal. Therefore, the flow allowance is promulgated as proposed.

FILM STRIPPING WET AIR POLLUTION CONTROL AND PRECIPITATION AND FILTRATION OF FILM STRIPPING SOLUTIONS WET AIR POLLUTION CONTROL

The BPT wastewater discharge rate at proposal for film stripping wet air pollution control was 0.485 l/troy ounce of silver produced from film stripping, based on 99 percent recycle. This rate was allocated only for plants practicing wet air pollution control for film stripping. One plant reported this wastewater, recycling 99+ percent. This plant used the same scrubber to control air emissions from film stripping and film stripping precipitation.

The BPT wastewater discharge allowance for film stripping and precipitation of film stripping solutions wet air pollution control is 0.97 l/troy ounce of silver produced from precipitation and filtration of film stripping solutions. Because the one plant that uses a wet scrubber on film stripping also uses the same scrubber on the precipitation of film stripping solutions, the Agency believes only one allowance is necessary. This allowance is based on 99 percent recycle of the water use at the one plant.

PRECIPITATION AND FILTRATION OF FILM STRIPPING SOLUTIONS

The BPT wastewater discharge rate at proposal for film stripping precipitation and filtration waste streams was 50.57 l/troy ounce of silver precipitated. Of the six plants with this process, four reported producing wastewater. The proposed BPT rate was based on the average discharge rate of two plants, which generated 112.7 and 2.31 l/troy ounce. A third plant reported insufficient data to calculate the discharge rate. Another plant reported this waste stream as a combination of photographic and nonphotographic wastewater; therefore, this plant also was omitted from the calculation.

The BPT wastewater discharge rate at promulgation for precipitation and filtration of film stripping solutions is 57.57 l/troy ounce of silver precipitated. Since proposal, data from plant 74 were clarified and a flow was attributed to precipitation of photographic film. The discharge rate at this plant is below the proposed allowance. The Agency received no new data or comments suggesting that the proposed allowance should be changed. Water use and wastewater discharge rates are presented in Table V-3 (page 2718).

PRECIPITATION AND FILTRATION OF PHOTOGRAPHIC SOLUTIONS

The BPT wastewater discharge rate at proposal for the precipitation and filtration of photographic solutions was 26.6 l/troy ounce of silver precipitated. Of the 15 plants reporting this process at proposal, nine discharged wastewater. Four plants did not provide sufficient data to calculate discharge rates. The discharge rates for the five other plants ranged from 1.6 to 89.9 l/troy ounce. The proposed BPT rate was based on the average of the discharge rates of these five plants.

The BPT wastewater discharge rate is 26.6 l/troy ounce of silver precipitated. This is equivalent to the proposed allowance. Data from plant 74, which precipitates silver from solutions resulting from photographic sludges, were added since proposal. However, these data support the proposed allowance. The Agency received no new data demonstrating that the proposed allowance should be changed. The distribution of wastewater discharge rates is presented in Table V-4 (page 2719).

PRECIPITATION AND FILTRATION OF PHOTOGRAPHIC SOLUTIONS WET AIR POLLUTION CONTROL

The BPT wastewater discharge rate at proposal for precipitation and filtration of photographic solutions wet air pollution control was 12.14 l/troy ounce of silver precipitated. This rate was allocated only to plants having wet air pollution control for precipitation and filtration of photographic solutions. Of the 15 plants that reported this process at proposal, four used wet air pollution control devices. Three of the four plants did not report sufficient production data to calculate a discharge rate for this waste stream, although sufficient data were reported to determine recycle practices. One of the four plants achieved zero discharge of this waste stream through complete recycle, while two plants practiced 99 percent recycle or greater. The fourth plant recycled 68 percent of its precipitation and filtration of photographic solutions wet air pollution control water. Thus, extensive recycle is possible for this wastewater stream. However, zero discharge may not be technically feasible unless a recycle system controls dissolved solids buildup, the wastewater is evaporated, or this wastewater can be reused in another production operation that can accept water of this quality. Some of these zero-discharge possibilities are site-specific and, therefore, are not applicable to all secondary silver pollutants that generate this wastewater. Therefore, a BPT wastewater discharge rate was allocated for precipitation and filtration of photographic solutions wet air pollution control. This discharge rate was based on 99 percent recycle of the water used for precipitation and filtration of photographic solutions wet air pollution control at the only plant for which a discharge rate could be determined. In the absence of other data, the Agency normally bases limits on 90 percent recycle of scrubber discharges; however, the plant that the discharge rate was based on recycled 99.9 percent of this wastewater, and two other plants practiced 99 and 100 percent recycle. Thus 99 percent recycle represented current subcategory practices for precipitation and filtration of photographic solutions wet air pollution control water.

The BPT wastewater discharge rate for precipitation and filtration of photographic solutions wet air pollution control is 12.14 l/troy ounce of silver precipitated. This is equivalent to the proposed allowance. Data from plant 74 were added since proposal. However, the scrubber at this plant is used over the film stripping and film stripping precipitation operations as well as the precipitation of photographic solutions process. For this reason, it was not considered representative of this subdivision and was not used to revise the regulatory allowance. The Agency received no new data demonstrating that the proposed flow allowance should be revised. Water use and wastewater discharge rates are presented in Table V-6 (page 2722).

ELECTROLYTIC REFINING

The BPT wastewater discharge rate at proposal for electrolytic refining was 0.76 l/troy ounce of silver refined. Of the 20 plants reporting electrolytic refining operations at proposal, 12 produced wastewater. Four plants reported insufficient data to calculate discharge rates. Data from seven plants, with discharge rates ranging from 0.068 to 1.97 l/troy ounce were used to calculate the BPT rate. Only one plant practiced recycle of this wastewater and achieved zero discharge by 100 percent reuse.

The promulgated BPT wastewater discharge rate for electrolytic refining is 0.76 l/troy ounce of silver refined. This is equivalent to the proposed allowance. New data received by the Agency after proposal support this allowance. The Agency believes there is no reason to change the proposed allowance based on the data received. The water use and discharge rates are presented in Table V-7 (page 2723).

FURNACE WET AIR POLLUTION CONTROL

The BPT wastewater discharge rate at proposal for the furnace air wet scrubbing stream was 0.67 l/troy ounce of silver smelted, roasted, or dried. This rate was allocated only for plants practicing wet air pollution control for furnace emissions. Emissions from furnace operations are controlled by dry or wet control devices. Common dry methods involve baghouses or dry electrostatic precipitators. Wet devices include packed bed, spray, and Venturi scrubbers, and wet electrostatic precipitators. Of the 19 plants reporting furnace air pollution control at proposal, 11 produced waste streams. Seven of the eleven plants achieved zero discharge through 100 percent recycle. Two of the four plants that discharged this waste stream practiced 99 percent recycle or greater, while one plant used a once-through operation. The remaining plant did not report production or wastewater flow data for this waste stream. The proposed BPT discharge rate was based on 99 percent recycle of the average water use at the three plants for which discharge rates were determined. The 99 percent recycle basis represented current subcategory practices since nine of the eleven plants that produced this waste stream recycled 99 percent or greater.

The BPT wastewater discharge rate for furnace wet air pollution control is 0.67 l/troy ounce of silver smelted, roasted, or dried. This is equivalent to the proposed BPT allowance. The Agency received new data from one plant with this waste stream. These data support the proposed allowance. The water use and wastewater discharge rates are shown in Table V-9 (page 2732). There are no new data demonstrating that proposed allowances should be changed. This allowance also includes the casting wet air pollution control allowance which was proposed. These two operations were identical and two allowances are not justified. Plants having smelting furnaces and casting furnaces use the same scrubber on both operations (e.g., plant 553).

LEACHING

The BPT discharge rate at proposal for plants with nonphotographic leaching processes was 0.086 l/troy ounce of silver produced from leaching. Of the 15 plants using this process at proposal, 12 discharged wastewater. Six plants supplied sufficient information to calculate discharge rates. Three plants with once-through discharge had rates ranging from 0.068 to 0.11 l/troy ounce. The proposed BPT rate was an average of the discharge from these three plants. Three other once-through dischargers reported rates ranging from 2.7 to 635.2 l/troy ounce. The rates from these three plants were omitted from the BPT rate calculation because there was no reason to believe that water is needed in these amounts, in light of rates from the other plants.

The BPT wastewater discharge rate for leaching is 0.086 l/troy ounce of silver produced from leaching. This is equivalent to the proposed allowance. Since proposal it was determined that the wastewater reported at plant 549 for leaching was actually precipitation of nonphotographic solutions wastewater. This did not affect the regulatory flow because this plant was not used to calculate the proposed allowance. Data from a plant received after proposal support the proposed allowance. The distribution of wastewater discharge rates is shown in Table V-10 (page 2733). The Agency received no data demonstrating that the proposed allowances should be revised.

LEACHING WET AIR POLLUTION CONTROL AND PRECIPITATION OF NONPHOTOGRAPHIC SOLUTIONS WET AIR POLLUTION CONTROL

The BPT wastewater discharge rate at proposal for nonphotographic leaching wet scrubbing was 4.43 l/troy ounce of silver produced from leaching. This rate was allocated only for plants using wet air pollution control on leaching processes. At proposal, three plants achieved zero discharge through 100 percent recycle or reuse. The recycle in seven additional plants ranged from 65 to 99+ percent, four of those using at least 99 percent. Some of the zero discharge possibilities were site-specific and are not applicable on a nationwide basis. The proposed BPT discharge rate was based on the average of five plants with discharge rates ranging from 0.014 to 11.3 l/troy ounce. Insufficient data to calculate a discharge rate were reported from three of the eight discharging plants.

The BPT wastewater discharge allowance is 4.43 l/troy ounce of silver produced from leaching or silver precipitated. This is equivalent to the proposed allowance. This allowance also replaces the proposed allowance for precipitation of nonphotographic solutions wet air pollution control. The Agency determined that the same scrubbers were used over both processes (leaching and precipitation) and two allowances were not justified. Water use and wastewater discharge rates are presented in Table V-11 (page 2734). The Agency received no new data demonstrating that the proposed allowance should be revised. The one plant submitting data for this scrubber subsequent to proposal practices 100 percent recycle.

PRECIPITATION AND FILTRATION OF NONPHOTOGRAPHIC SOLUTIONS

The BPT wastewater discharge rate at proposal for nonphotographic precipitation and filtration was 3.07 l/troy ounce of silver precipitated. Of the nine plants using this process at proposal, two produced no wastewater. Three plants supplied insufficient information to calculate discharge rates. Four plants were once-through dischargers with rates ranging from 0.42 to 78.6 l/troy ounce. The proposed BPT discharge rate was based on the average discharge rate of three of these plants. The plant with the 78.6 l/troy ounce rate was not considered in the average because this discharge rate was nearly ten times that of the next highest plant.

The BPT wastewater discharge allowance at promulgation is 3.07 l/troy ounce of silver precipitated. This is equivalent to the proposed allowance. The Agency received revised or new data from 18 plants. The water use and wastewater discharge rates are presented in Table V-12 (page 2735). After excessive water users are discarded, the data support the proposed allowance. The Agency believes there is no reason to revise the proposed allowance.

FLOOR AND EQUIPMENT WASHDOWN

No BPT wastewater discharge allowance will be provided for floor and equipment washdown. Many plants generate this wastewater while recovering silver contained in spills and leaks of process solutions. Plants usually precipitate the silver by cementation before discharging the wastewater. The Agency believes that this wastewater can be reused as washdown water after toxic metals and total suspended solids removal during treatment. The compliance costs for the treatment system reflect the additional capacity and equipment needed to achieve complete recycle of this waste stream.

REGULATED POLLUTANT PARAMETERS

The raw wastewater concentrations from individual operations and the subcategory as a whole were examined to select certain pollutant parameters for limitation. This examination and evaluation was presented in Section VI. Five pollutant parameters are selected for limitation under BPT and are listed below:

120. copper
128. zinc
ammonia (N)
total suspended solids (TSS)
pH

The concentrations achievable by application of the proposed BPT treatment are explained in Section VII of this supplement. The achievable treatment concentrations (both one-day maximum and monthly average values) are multiplied by the BPT normalized discharge flows summarized in Table IX-1 (page 2791) to calculate the mass of pollutants allowed to be discharged per mass of product. The results of these calculations in milligrams of pollutant per troy ounce of product represent the BPT effluent limitations and are presented in Table IX-2 (page 2793) for each individual waste stream.

Table IX-1

BPT WASTEWATER DISCHARGE RATES FOR THE SECONDARY SILVER SUBCATEGORY

Wastewater Stream	BPT Normalized Discharge Rate 1/troy ounce	Production Normalizing Parameter
Film stripping	50.35	troy ounces of silver produced from film stripping
Film stripping wet air pollution control and precipitation and filtration of film stripping solutions wet air pollution control	0.97	troy ounces of silver produced from precipitation and filtration of film stripping solutions
Precipitation and filtration of film stripping solutions	57.57	troy ounces of silver precipitated
Precipitation and filtration of photographic solutions	26.6	troy ounces of silver precipitated
Precipitation and filtration of photographic solutions wet air pollution control	12.14	troy ounces of silver precipitated
Electrolytic refining	0.76	troy ounces of silver refined
Furnace wet air pollution control	0.67	troy ounces of silver smelted, roasted, or dried

Table IX-1 (Continued)

BPT WASTEWATER DISCHARGE RATES FOR THE SECONDARY SILVER SUBCATEGORY

Wastewater Stream	BPT Normalized Discharge Rate 1/troy ounce	Production Normalizing Parameter
Leaching	0.086	troy ounces of silver produced from leaching
Leaching wet air pollution control and precipitation of nonphotographic solutions wet air pollution control	4.43	troy ounces of silver produced from leaching or precipitation
Precipitation and filtration of nonphotographic solutions	3.07	troy ounces of silver precipitated
Floor and equipment washdown wastewater	0	troy ounces of silver produced

TABLE IX-2

BPT EFFLUENT LIMITATIONS FOR THE SECONDARY SILVER SUBCATEGORY

(a) Film Stripping BPT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver from film stripping		
Antimony		
Arsenic	144.500	64.450
Cadmium	105.200	46.830
Chromium	17.120	7.553
*Copper	22.150	9.063
Lead	95.660	50.350
Nickel	21.150	10.070
Selenium	96.670	63.950
Silver	61.930	27.690
Thallium	20.640	8.560
*Zinc	103.200	45.209
*Ammonia (as N)	73.510	30.710
*TSS	6712.000	2951.000
*pH	2064.000	981.800
	Within the range of 7.5 to 10.0 at all times	

(b) Film Stripping Wet Air Pollution Control and Precipitation and Filtration of Film Stripping Solutions Wet Air Pollution Control BPT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver from precipitation and filtration of film stripping solutions		
Antimony		
Arsenic	2.784	1.242
Cadmium	2.027	0.902
Chromium	0.330	0.146
*Copper	0.427	0.175
Lead	1.843	0.970
Nickel	0.407	0.194
Selenium	1.862	1.232
Silver	1.193	0.534
Thallium	0.398	0.165
*Zinc	1.988	0.883
*Ammonia (as N)	1.416	0.592
*TSS	129.300	56.840
*pH	39.770	18.920
	Within the range of 7.5 to 10.0 at all times	

*Regulated Pollutant

TABLE IX-2 (Continued)

BPT EFFLUENT LIMITATIONS FOR THE SECONDARY SILVER SUBCATEGORY

(c) Precipitation and Filtration of Film Stripping Solutions BPT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/troy ounce of silver precipitated	
Antimony	165.230	73.690
Arsenic	120.320	53.540
Cadmium	19.570	8.636
Chromium	25.330	10.360
*Copper	109.400	57.570
Lead	24.180	11.510
Nickel	110.500	73.110
Selenium	70.810	31.660
Silver	23.600	9.787
Thallium	118.000	52.390
*Zinc	84.050	35.120
*Ammonia (as N)	7674.000	3374.000
*TSS	2360.000	1123.000
*pH	Within the range of 7.5 to 10.0 at all times	

(d) Precipitation and Filtration of Photographic Solutions BPT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/troy ounce of silver precipitated	
Antimony	76.340	34.050
Arsenic	55.590	24.740
Cadmium	0.044	3.990
Chromium	11.700	4.788
*Copper	50.540	26.600
Lead	11.170	5.320
Nickel	51.070	33.780
Selenium	32.720	14.630
Silver	10.910	4.522
Thallium	54.530	24.210
*Zinc	38.840	16.230
*Ammonia (as N)	3546.000	1559.000
*TSS	1091.000	518.700
*pH	Within the range of 7.5 to 10.0 at all times	

*Regulated Pollutant

TABLE IX-2 (Continued)

BPT EFFLUENT LIMITATIONS FOR THE SECONDARY SILVER SUBCATEGORY

(e) Precipitation and Filtration of Photographic Solutions Wet Air Pollution Control BPT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver from precipitation and filtration of photographic solutions		
Antimony	34.840	15.540
Arsenic	25.370	11.290
Cadmium	4.128	1.821
Chromium	5.342	2.185
*Copper	23.070	12.140
Lead	5.099	2.428
Nickel	23.310	15.420
Selenium	14.930	6.677
Silver	4.977	2.064
Thallium	24.890	11.050
*Zinc	17.720	7.405
*Ammonia (as N)	1618.000	711.400
*TSS	497.700	236.700
*pH	Within the range of 7.5 to 10.0 at all times	

(f) Electrolytic Refining BPT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver from electrolytic refining		
Antimony	2.181	0.973
Arsenic	1.588	0.707
Cadmium	0.258	0.114
Chromium	0.334	0.137
*Copper	1.444	0.760
Lead	0.319	0.152
Nickel	1.459	0.965
Selenium	0.935	0.418
Silver	0.312	0.129
Thallium	1.558	0.692
*Zinc	1.110	0.646
*Ammonia (as N)	101.310	44.540
*TSS	31.160	14.820
*pH	Within the range of 7.5 to 10.0 at all times	

*Regulated Pollutant

TABLE IX-2 (Continued)

BPT EFFLUENT LIMITATIONS FOR THE SECONDARY SILVER SUBCATEGORY

(g) Furnace Wet Air Pollution Control BPT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/troy ounce of silver roasted, smelted or dried	
Antimony	1.923	0.858
Arsenic	1.400	0.623
Cadmium	0.228	0.101
Chromium	0.295	0.121
*Copper	1.273	0.670
Lead	0.281	0.134
Nickel	1.286	0.851
Selenium	0.824	0.369
Silver	0.275	0.114
Thallium	1.374	0.610
*Zinc	0.978	0.409
*Ammonia (as N)	89.310	39.260
*TSS	27.470	13.070
*pH	Within the range of 7.5 to 10.0 at all times	

(h) Leaching BPT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/troy ounce of silver produced from leaching	
Antimony	0.247	0.110
Arsenic	1.180	0.080
Cadmium	0.029	0.013
Chromium	0.038	0.015
*Copper	0.163	0.086
Lead	0.036	0.017
Nickel	0.165	0.109
Selenium	0.106	0.047
Silver	0.035	0.015
Thallium	0.176	0.078
*Zinc	0.126	0.052
*Ammonia (as N)	11.460	5.040
*TSS	3.526	1.677
*pH	Within the range of 7.5 to 10.0 at all times	

*Regulated Pollutant

TABLE IX-2 (Continued)

BPT EFFLUENT LIMITATIONS FOR THE SECONDARY SILVER SUBCATEGORY

(i) Leaching Wet Air Pollution Control and Precipitation of Nonphotographic Solutions Wet Air Pollution Control BPT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy oz. of silver produced from leaching or silver precipitated		
Antimony	12.710	5.670
Arsenic	9.259	4.120
Cadmium	1.506	0.665
Chromium	1.949	0.797
*Copper	8.417	4.430
Lead	1.861	0.886
Nickel	8.506	5.626
Selenium	5.449	2.437
Silver	1.816	0.753
Thallium	9.082	4.031
*Zinc	6.468	2.702
*Ammonia (as N)	590.500	259.600
*TSS	181.600	86.390
*pH	Within the range of 7.5 to 10.0 at all times	

(j) Precipitation and Filtration of Nonphotographic Solutions BPT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver precipitated		
Antimony	8.811	3.930
Arsenic	6.416	2.855
Cadmium	1.044	0.461
Chromium	1.351	0.553
*Copper	5.833	3.070
Lead	1.289	0.614
Nickel	5.894	3.899
Selenium	3.776	1.689
Silver	1.259	0.522
Thallium	6.293	2.794
*Zinc	4.482	1.873
*Ammonia (as N)	409.200	170.900
*TSS	125.900	59.870
*pH	Within the range of 7.5 to 10.0 at all times	

*Regulated Pollutant

TABLE IX-2 (Continued)

BPT EFFLUENT LIMITATIONS FOR THE SECONDARY SILVER SUBCATEGORY

(k) Floor and Equipment Washdown Water BPT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/troy ounce of silver production	
Antimony	0.000	0.000
Arsenic	0.000	0.000
Cadmium	0.000	0.000
Chromium	0.000	0.000
*Copper	0.000	0.000
Lead	0.000	0.000
Nickel	0.000	0.000
Selenium	0.000	0.000
Silver	0.000	0.000
Thallium	0.000	0.000
*Zinc	0.000	0.000
*Ammonia (as N)	0.000	0.000
*TSS	0.000	0.000
*pH	Within the range of 7.5 to 10.0 at all times	

*Regulated Pollutant

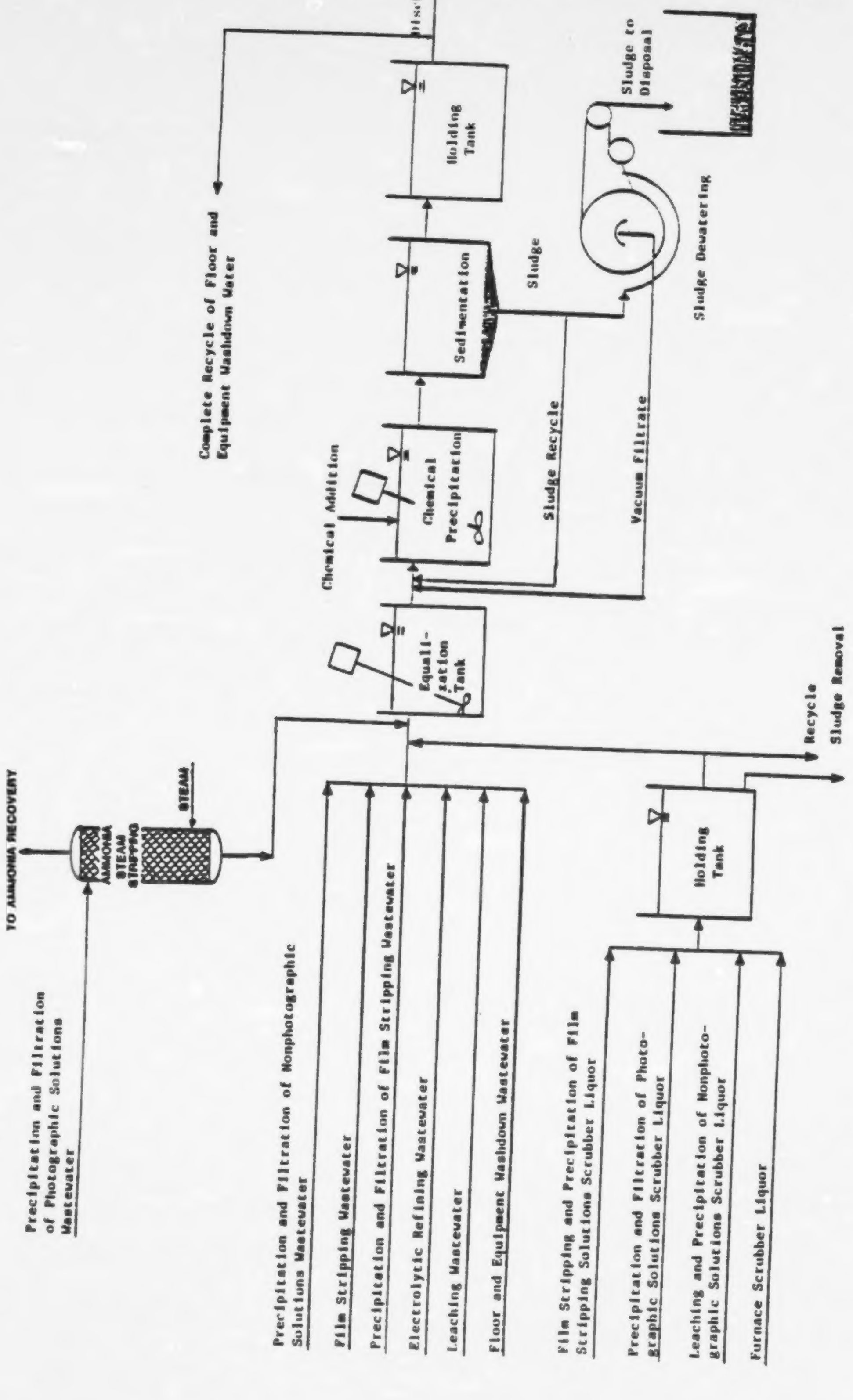
Precipitation and Filtration of Photographic Solutions Wastewater
TO AMMONIA RECOVERY
AMMONIA STEAM STRIPPING
STEAM
Precipitation and Filtration of Nonphotographic Solutions Wastewater
Film Stripping Wastewater
Precipitation and Filtration of Film Stripping Wastewater
Electrolytic Refining Wastewater
Leaching Wastewater
Floor and Equipment Washdown Wastewater
Film Stripping and Precipitation of Film Stripping Solutions Scrubber Liquor
Precipitation and Filtration of Photographic Solutions Scrubber Liquor
Leaching and Precipitation of Nonphotographic Solutions Scrubber Liquor
Furnace Scrubber Liquor
Holding Tank
Recycle
Sludge Removal
Equalization Tank
Chemical Addition
Chemical Precipitation
Sludge Recycle
Vacuum Filtrate
Sedimentation
Sludge
Holding Tank
Complete Recycle of Floor and Equipment Washdown Water
Discharge
Sludge Dewatering
Sludge to Disposal

Figure IX-1

BPT TREATMENT SCHEME
SECONDARY SILVER SUBCATEGORY

SECTION X

BEST AVAILABLE TECHNOLOGY ECONOMICALLY ACHIEVABLE

These effluent limitations are based on the best control and treatment technology used by a specific point source within the industrial category or subcategory, or by another category from which the technology is transferable. Emphasis is placed on additional treatment techniques applied at the end of the treatment systems currently used, as well as reduction of the amount of water used and discharged, process control, and treatment technology optimization.

The factors considered in assessing best available technology economically achievable (BAT) include the age of equipment and facilities involved, the process used, process changes, nonwater quality environmental impacts (including energy requirements), and the costs of application of such technology. BAT may include feasible process changes or internal controls, even when not in common practice.

The statutory assessment of BAT considers costs, but does not require a balancing of costs against effluent reduction benefits. However, in assessing BAT, the Agency has given substantial weight to the economic achievability of the technology.

TECHNICAL APPROACH TO BAT

The Agency reviewed a wide range of technology options and evaluated the available possibilities to ensure that the most effective and beneficial technologies were used as the basis of BAT. To accomplish this, the Agency elected to examine three technology options which could be applied to the secondary silver subcategory as alternatives for the basis of BAT effluent limitations.

For the development of BAT effluent limitations, mass loadings were calculated for each wastewater source or subdivision in the subcategory using the same technical approach as described in Section IX for BPT limitations development. The differences in the mass loadings for BPT and BAT are due to increased treatment effectiveness achievable with the more sophisticated BAT treatment technology and reductions in the effluent flows allocated to various waste streams.

In summary, the treatment technologies considered for the secondary silver subcategory are:

Option A (Figure X-1, page 2818) is based on

- Preliminary treatment of precipitation and filtration of photographic solutions wastewater with ammonia steam stripping
- Chemical precipitation and sedimentation
- Complete recycle of floor and equipment washdown wastewater after treatment

Option B (Figure X-2, page 2819) is based on

- In-process flow reduction of wet air pollution control water
- Preliminary treatment of precipitation and filtration of photographic solutions wastewater with ammonia steam stripping
- Chemical precipitation and sedimentation
- Complete recycle of floor and equipment washdown wastewater after treatment

Option C (Figure X-3, page 2820) is based on

- In-process flow reduction of wet air pollution control water
- Preliminary treatment of precipitation and filtration of photographic solutions wastewater with ammonia steam stripping
- Chemical precipitation and sedimentation
- Complete recycle of floor and equipment washdown wastewater after treatment
- Multimedia filtration

The three options examined for BAT are discussed in greater detail below. The first option considered is the same as the BPT treatment technology which was presented in the previous section.

OPTION A

Option A for the secondary silver subcategory is equivalent to the control and treatment technologies which were analyzed for BPT in Section IX. The BPT end-of-pipe treatment scheme includes chemical precipitation, and sedimentation (lime and settle), with preliminary treatment of precipitation and filtration of photographic solutions wastewater with ammonia steam stripping (see Figure X-1). Complete recycle of treated floor and equipment washdown wastewater is also included. The discharge rates for Option A are equal to the discharge rates allocated to each stream as a BPT discharge flow.

OPTION B

Option B for the secondary silver subcategory achieves lower pollutant discharge by building upon the Option A (ammonia steam stripping, chemical precipitation, sedimentation, and recycle of treated floor and equipment washdown wastewater) treatment technology. Flow reduction measures are added to the Option A treatment scheme (see Figure X-2). These flow reduction measures, including in-process changes, result in the elimination of some wastewater streams and the concentration of pollutants in other effluents. As explained in Section VII of the General Development Document, treatment of a more concentrated effluent allows achievement of a greater net pollutant removal and introduces the possible economic benefits associated with treating a lower volume of wastewater.

Option B flow reduction measures are reflected in the BAT wastewater discharge rates. Flow reduction has been included in determining the BAT discharge rates for furnace wet air pollution control. Based on available data, the Agency did not feel that further flow reduction over BPT would be feasible for the remaining 10 waste streams in the secondary silver subcategory.

Flow reduction measures used in Option B to reduce process wastewater generation or discharge rates include the following:

There are four wastewater sources associated with wet air pollution control which are regulated under these effluent limitations:

1. Film stripping scrubber and precipitation of film stripping solutions scrubber,
2. Precipitation and filtration of photographic solutions scrubber,
3. Furnace scrubber, and
4. Leaching and precipitation of nonphotographic solutions scrubber.

Table X-1 (page 2818) presents the number of plants reporting wastewater with the wet air pollution control sources listed above, the number of plants practicing recycle, and the range of recycle values being listed. Complete recycle of furnace scrubber water will be required for BAT. The Agency is not requiring further flow reduction at BAT for the remaining wet air pollution control waste streams.

OPTION C

Option C for the secondary silver subcategory consists of all control and treatment requirements of Option B (in-process flow reduction, ammonia steam stripping, chemical precipitation, sedimentation, and recycle of treated floor and equipment washdown wastewater) plus multimedia filtration technology added at the end of the Option B treatment scheme (see Figure X-3). Multimedia filtration is used to remove suspended solids, including precipitates of toxic metals, beyond the concentration attainable by gravity sedimentation. The filter suggested is of the gravity, mixed media type, although other filters, such as rapid sand filters or pressure filters, would perform satisfactorily.

As one means of evaluating each technology option, EPA developed estimates of the pollutant removal estimates and the compliance costs associated with each option. The methodologies are described below.

POLLUTANT REMOVAL ESTIMATES

A complete description of the methodology used to calculate the estimated pollutant removals achieved by the application of the various treatment options is presented in Section X of Vol. I. The pollutant removal estimates have been revised from proposal based on comments and new data. However, the methodology for calculating pollutant removals was not changed. The data used for estimating removals are the same as those used to revise the compliance costs.

Sampling data collected during the field sampling program were used to characterize the major waste streams considered for regulation. At each sampled facility, the sampling data were production normalized for each unit operation (i.e., mass of pollutant generated per mass of product manufactured). This value, referred to as the raw waste, was used to estimate the mass of toxic pollutants generated within the secondary silver subcategory. By multiplying the total subcategory production for a unit operation by the corresponding raw waste value, the mass of pollutant generated for that unit operation was estimated.

The volume of wastewater discharged after the application of each treatment option was estimated for each operation at each plant by comparing the actual discharge to the regulatory flow. The smaller of the two values was selected and summed with the other plant flows. The mass of pollutant discharged was then estimated by multiplying the achievable concentration values attainable by the option (mg/l) by the estimated volume of process wastewater discharged by the subcategory. The mass of pollutant removed is simply the difference between the estimated mass of pollutant generated within the subcategory and the mass of pollutant discharged after application of the treatment option. The pollutant removal estimates for direct dischargers in the secondary silver subcategory are presented in Table X-2 (page 2819).

COMPLIANCE COSTS

Compliance costs presented at proposal were estimated using cost curves, which related the total costs associated with installation and operation of wastewater treatment technologies to plant process wastewater discharge. EPA applied these curves on a per plant basis, a plant's costs -- both capital, and operating and maintenance -- being determined by what treatment it has in place and by its individual process wastewater discharge (from dcp). The final step was to annualize the capital costs, and to sum the annualized capital costs, and the operating and maintenance costs, yielding the cost of compliance for the subcategory. Since proposal, the cost estimation methodology has been changed as discussed in Section VIII of this document and in Section VIII of Vol. I. A design model and plant-specific information were used to size a wastewater treatment system for each discharging facility. After completion of the design, capital and annual costs were estimated for each unit of the wastewater treatment system. Capital costs were developed from vendor quotes and annual costs were developed from literature. The revised compliance costs are presented in Table VIII-1 (page 2776).

BAT OPTION SELECTION - PROPOSAL

At proposal, EPA selected both Option B and Option C as the basis for alternative BAT effluent limitations for the secondary silver subcategory due to adverse structural economic changes that the Agency suspected were not reflected in the Agency's proposed economic analysis. These alternative limitations were based on ammonia steam stripping preliminary treatment, lime precipitation and sedimentation, end-of-pipe technology, and in-process control technologies to reduce the volume of process wastewater discharged for Option B, and the addition of multimedia filtration to the end-of-pipe technology for Option C.

Option E was eliminated because the addition of activated carbon technology is not necessary since toxic organic pollutants are not selected for limitation in this subcategory.

BAT OPTION SELECTION - PROMULGATION

EPA is promulgating BAT effluent mass limitations based on lime precipitation and sedimentation and ammonia steam stripping with additional reduction in pollutant discharge with the use of filtration as an effluent polishing step. The end-of-pipe and pretreatment technology basis for BAT limitations being promulgated is the same as that proposed for Alternative B. The Agency expressed concerns at proposal about this option's economic achievability, but after revising the compliance costs and the economic analysis, the Agency believes that filtration as an end-of-pipe treatment technology is economically achievable. The treatment performance concentrations upon which the mass limitations are based are equal to values used to calculate the proposed mass limitations.

Application of the promulgated BAT would remove 31,000 kg/yr of toxic metals and 664,154 kg/yr of ammonia over the estimated raw discharge. The BAT effluent mass limitations will remove 132 kg/yr of toxic pollutants above the estimated BPT discharge. The option is economically achievable. EPA believes that incremental removal justifies selection of filtration as part of BAT model technology. In addition, filtration is demonstrated at 11 secondary silver facilities. The estimated capital investment cost of the promulgated BAT is $278,000 (March, 1982 dollars) and the annual cost is $390,000 (March, 1982 dollars).

WASTEWATER DISCHARGE RATES

A BAT discharge rate was calculated for each subdivision based upon the flows of the existing plants, as determined from analysis of the data collection portfolios. The discharge rate is used with the achievable treatment concentration to determine BAT effluent limitations. Since the discharge rate may be different for each wastewater source, separate production normalized discharge rates for each of the 11 wastewater sources were determined and are summarized in Table X-3 (page 2810). The discharge rates are normalized on a production basis by relating the amount of wastewater generated to the mass of the intermediate product which is produced by the process associated with the waste stream in question. These production normalizing parameters (PNP) are also listed in Table X-3.

As discussed previously, the BAT wastewater discharge rate equals the BPT wastewater discharge rate for 10 of the 11 waste streams in the secondary silver subcategory. Based on the available data, the Agency did not feel that further flow reduction would be feasible for these wastewater sources. Wastewater streams for which BAT discharge rates differ from BPT are discussed below.

FURNACE WET AIR POLLUTION CONTROL

No BAT wastewater discharge allowance was provided for furnace wet air pollution control at proposal. This rate applies to all air pollution control of furnace operations and was based on complete recycle of wastewater. Since 15 of the 19 plants with furnace air pollution control did not discharge water, including plants with wet scrubber systems, the Agency believed that zero discharge is feasible for all secondary silver furnace air pollution control.

No BAT wastewater discharge allowance is provided for furnace wet air pollution control for promulgation. Only five of the 19 plants with furnace air pollution control currently discharge wastewater. The Agency believes, as it did at proposal, that zero discharge is feasible for all secondary silver furnace air pollution control. No comments were received challenging the Agency's conclusion.

REGULATED POLLUTANT PARAMETERS

In implementing the terms of the Consent Agreement in NRDC v. Train, Op. Cit., and 33 U.S.C. {1314(b)(2)(A and B) (1976), the Agency placed particular emphasis on the toxic pollutants. The raw wastewater concentrations from individual operations and the subcategory as a whole were examined to select certain pollutant parameters for consideration for limitation. This examination and evaluation, presented in Section VI, concluded that 26 pollutants and pollutant parameters are present in secondary silver wastewaters at concentrations than can be effectively reduced by identified treatment technologies. (Refer to Section VI.)

However, the cost associated with analysis for toxic metal pollutants has prompted EPA to develop an alternative method for regulating and monitoring toxic pollutant discharges from the nonferrous metals manufacturing category. Rather than developing specific effluent mass limitations and standards for each of the toxic metals found in treatable concentrations in the raw wastewaters from a given subcategory, the Agency is promulgating effluent mass limitations only for those pollutants generated in the greatest quantities as shown by the pollutant removal estimates analysis. The pollutants selected for specific limitation are listed below:

120. copper
128. zinc
ammonia

By establishing limitations and standards for certain toxic metal pollutants, dischargers will attain the same degree of control over toxic metal pollutants as they would have been required to achieve had all the toxic metal pollutants been directly limited.

This approach is justified technically since the treatable concentrations used for lime precipitation and sedimentation technology are based on optimized treatment for concomitant multiple metals removal. Thus, even though metals have somewhat different theoretical solubilities, they will be removed at very nearly the same rate in a lime precipitation and sedimentation treatment system operated for multiple metals removal. Filtration as part of the technology basis is likewise justified because this technology removes metals non-preferentially.

The toxic metal pollutants selected for specific limitation in the secondary silver subcategory to control the discharges of toxic metal pollutants are copper and zinc. Ammonia is also selected for limitation since the methods used to control copper and zinc are not effective in the control of ammonia.

The following toxic pollutants are excluded from limitation on the basis that they are effectively controlled by the limitations developed for copper and zinc:

114. antimony
115. arsenic
118. cadmium
119. chromium
122. lead
124. nickel
125. selenium
126. silver

127. thallium

The Agency believes that the organic pollutants in this subcategory are present only in trace (deminimus quantities) and are neither causing nor likely to cause toxic effects. Therefore, the following organic pollutants are excluded from limitation:

4. benzene
6. carbon tetrachloride
10. 1,2-dichloroethane
11. 1,1,1-trichloroethane
29. 1,1-dichloroethylene
30. 1,2-trans-dichloroethylene
38. ethylbenzene
84. pyrene
85. tetrachloroethylene
86. toluene
87. trichloroethylene, and
total phenols (by 4-AAP method)

Cyanide was present in the secondary silver subcategory in certain waste streams at concentrations that can be effectively reduced by identified treatment technologies. Treatable concentrations of cyanide were found in one photographic materials plant and one nonphotographic materials plant. Five different process waste streams were sampled; four contained cyanide at treatable concentrations, in six of nine samples. However, at proposal, when waste streams were combined for treatment, cyanide was found at a concentration below that achievable by identified treatment technology. This determination was made by comparing the raw (untreated) wasteload and treated discharge estimates presented in the pollutant removal estimates. Cyanide was thus excluded from limitation.

For promulgation, cyanide is not chosen as a regulated pollutant parameter on a subcategory-wide basis for the secondary silver mass limitations. However, secondary silver plants process plating solutions, which may contain cyanide, to recover silver contained in the solution. Cyanide is present due to its use as a process chemical in plating operations. The permitting authority should check for the presence of cyanide in this waste stream and develop discharge limitations if necessary. A discharge allowance can be developed by locating the flow allowance for precipitation and filtration of nonphotographic solutions at BPT and BAT in Sections IX and X, respectively, of the secondary silver supplemental development document. Treatment performance for cyanide precipitation is presented in Section VII of the General Development Document. The discharge allowance (or mass limitation) is the product of the flow allowance and the treatment performance.

EFFLUENT LIMITATIONS

The treatable concentrations, achievable by application of the

BAT technology (Option C) are summarized in Section VII of this supplement. These treatable concentrations (both one day maximum and monthly average) are multiplied by the BAT normalized discharge flows summarized in Table X-3 (page 2810) to calculate the mass of pollutants allowed to be discharged per mass of product. The results of these calculations in milligrams of pollutant per troy ounce of product represent the BAT effluent limitations for the secondary silver subcategory. The BAT effluent limitations are presented in Table X-4 (page 2811).

Table X-1

CURRENT RECYCLE PRACTICES WITHIN THE SECONDARY SILVER SUBCATEGORY

	Number of Plants with Wastewater	Number of Plants Practicing Recycle	Range of Recycle Values (%)
Film stripping and precipitation of film stripping solutions scrubber	1	1	99+
Photographic solution precipitation and filtration scrubber	3	3	99.93 - 100
Furnace scrubber	11	7	99.7 - 100
Leaching and precipitation of nonphotographic solutions scrubber	13	8	99 - 100

Table X-2

POLLUTANT REMOVAL ESTIMATES FOR SECONDARY SILVER DIRECT DISCHARGERS

POLLUTANT	TOTAL RAW WASTE (kg/yr)	OPTION A DISCHARGED (kg/yr)	OPTION A REMOVED (kg/yr)	OPTION B DISCHARGED (kg/yr)	OPTION B REMOVED (kg/yr)	OPTION C DISCHARGED (kg/yr)	OPTION C REMOVED (kg/yr)
Arsenic	6.2	6.2	0.0	6.2	0.0	6.2	0.0
Antimony	7.0	7.0	0.0	7.0	0.0	7.0	0.0
Cadmium	7.6	7.6	0.0	7.6	0.0	7.6	0.0
Chromium	87.1	71.7	15.4	71.7	15.4	59.8	27.3
Lead	112.8	102.5	10.3	102.5	10.3	68.3	44.4
Nickel	126.6	126.6	0.0	126.6	0.0	126.6	0.0
Selenium	9.0	9.0	0.0	9.0	0.0	9.0	0.0
Silver	6.9	6.9	0.0	6.9	0.0	6.9	0.0
Thallium	0.5	0.5	0.0	0.5	0.0	0.5	0.0
Copper	224.2	224.2	0.0	224.2	0.0	224.2	0.0
Zinc	31,125.3	281.8	30,843.5	281.8	30,843.5	196.4	30,928.9
TOTAL TOXIC METALS	31,713.3	844.1	30,869.2	844.1	30,869.2	712.6	31,000.7
Ammonia	691,477.2	27,323.2	664,154.0	27,323.2	664,154.0	27,323.2	664,154.0
TOTAL NONCONVENTIONALS	691,477.2	27,323.2	664,154.0	27,323.2	664,154.0	27,323.2	664,154.0
TSS	17,999.2	10,246.2	7,753.0	10,246.2	7,753.0	2,220.0	15,779.2
TOTAL CONVENTIONALS	17,999.2	10,246.2	7,753.0	10,246.2	7,753.0	2,220.0	15,779.2
TOTAL POLLUTANTS	741,189.7	38,413.5	702,776.1	38,413.5	702,776.1	30,255.8	710,933.8
FLOW (l/yr)		853,850,000		853,850,000		853,850,000	

NOTE: TOTAL TOXIC METALS = Arsenic + Antimony + Cadmium + Chromium + Lead + Nickel + Selenium + Silver + Thallium + Copper + Zinc
TOTAL CONVENTIONALS = TSS
TOTAL POLLUTANTS = Total Toxic Metals + Total Nonconventionals + Total Conventionals

OPTION A = Ammonia Steam Stripping, Lime Precipitation, and Sedimentation
OPTION B = Option A, plus In-Process Flow Reduction
OPTION C = Option B, plus Multimedia Filtration

Table X-3

BAT WASTEWATER DISCHARGE RATES FOR THE SECONDARY SILVER SUBCATEGORY

Wastewater Stream	BAT Normalized Discharge Rate l/troy ounce	Production Normalizing Parameter
Film stripping	50.35	troy ounces of silver produced from film stripping
Film stripping wet air pollution control and precipitation and filtration of film stripping solutions wet air pollution control	0.97	troy ounces of silver produced from precipitation and filtration of film stripping solutions
Precipitation and filtration of film stripping solutions	57.57	troy ounces of silver precipitated
Precipitation and filtration of photographic solutions	26.6	troy ounces of silver precipitated
Precipitation and filtration of photographic solutions wet air pollution control	12.14	troy ounces of silver precipitated
Electrolytic refining	0.76	troy ounces of silver refined
Furnace wet air pollution control	0	troy ounces of silver smelted, roasted, or dried

Table X-3 (Continued)

BAT WASTEWATER DISCHARGE RATES FOR THE SECONDARY SILVER SUBCATEGORY

Wastewater Stream	BAT Normalized Discharge Rate 1/troy ounce	Production Normalizing Parameter
Leaching	0.086	troy ounces of silver produced from leaching
Leaching wet air pollution control and precipitation of nonphotographic solutions wet air pollution control	4.43	troy ounces of silver produced from leaching or precipitation
Precipitation and filtration of nonphotographic solutions	3.07	troy ounces of silver precipitated
Floor and equipment washdown wastewater	0	troy ounces of silver produced

TABLE X-4

BAT EFFLUENT LIMITATIONS FOR THE SECONDARY SILVER SUBCATEGORY

(a) Film Stripping BAT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver from film stripping		
Antimony	97.180	43.300
Arsenic	69.990	31.220
Cadmium	10.070	4.028
Chromium	18.630	7.553
*Copper	64.450	30.710
Lead	14.100	6.546
Nickel	27.690	18.630
Selenium	41.290	18.630
Silver	14.600	6.042
Thallium	70.490	30.710
*Zinc	51.360	21.150
*Ammonia (as N)	6712.000	2951.000

(b) Film Stripping Wet Air Pollution Control and Precipitation and Filtration of Film Stripping Solutions Wet Air Pollution Control BAT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver from precipitation and filtration of film stripping solutions		
Antimony	1.872	0.834
Arsenic	1.348	0.601
Cadmium	0.194	0.078
Chromium	0.359	0.146
*Copper	1.242	0.592
Lead	0.272	0.126
Nickel	0.534	0.359
Selenium	0.795	0.359
Silver	0.281	0.116
Thallium	1.358	0.592
*Zinc	0.989	0.407
*Ammonia (as N)	129.300	56.840

*Regulated Pollutant

TABLE X-4 (Continued)

BAT EFFLUENT LIMITATIONS FOR THE SECONDARY SILVER SUBCATEGORY

(c) Precipitation and Filtration of Film Stripping Solutions
BAT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/troy ounce of silver precipitated	
Antimony	111.100	49.510
Arsenic	80.020	35.690
Cadmium	11.510	4.606
Chromium	21.300	8.636
*Copper	73.690	35.120
Lead	16.120	7.484
Nickel	31.660	21.300
Selenium	47.210	21.300
Silver	16.700	6.908
Thallium	80.600	35.120
*Zinc	58.720	24.180
*Ammonia (as N)	7674.000	3374.000

(d) Precipitation and Filtration of Photographic Solutions
BAT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/troy ounce of silver precipitated	
Antimony	51.340	22.880
Arsenic	36.970	16.490
Cadmium	5.320	2.128
Chromium	9.842	3.990
*Copper	34.050	16.230
Lead	7.448	3.458
Nickel	14.630	9.842
Selenium	21.810	9.842
Silver	7.714	3.192
Thallium	37.240	16.230
*Zinc	27.130	11.170
*Ammonia (as N)	3546.000	1559.000

*Regulated Pollutant

TABLE X-4 (Continued)

BAT EFFLUENT LIMITATIONS FOR THE SECONDARY SILVER SUBCATEGORY

(e) Precipitation and Filtration of Photographic Solutions Wet Air Pollution Control BAT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver from precipitation and filtration of photographic solutions		
Antimony	23.430	10.440
Arsenic	16.880	7.527
Cadmium	2.428	0.971
Chromium	4.492	1.821
*Copper	15.540	7.405
Lead	3.399	1.578
Nickel	6.677	4.492
Selenium	9.955	4.492
Silver	3.521	1.457
Thallium	17.000	7.405
*Zinc	12.380	5.099
*Ammonia (as N)	1618.000	711.400

(f) Electrolytic Refining BAT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver from electrolytic refining		
Antimony	1.467	0.654
Arsenic	1.056	0.471
Cadmium	0.152	0.061
Chromium	0.281	0.114
*Copper	0.973	0.464
Lead	0.213	0.099
Nickel	0.418	0.281
Selenium	0.623	0.281
Silver	0.220	0.091
Thallium	1.064	0.464
*Zinc	0.775	0.319
*Ammonia (as N)	101.300	44.540

*Regulated Pollutant

TABLE X-4 (Continued)

BAT EFFLUENT LIMITATIONS FOR THE SECONDARY SILVER SUBCATEGORY

(g) Furnace Wet Air Pollution Control BAT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver from silver roasted, smelted, or dried		
Antimony	0.000	0.000
Arsenic	0.000	0.000
Cadmium	0.000	0.000
Chromium	0.000	0.000
*Copper	0.000	0.000
Lead	0.000	0.000
Nickel	0.000	0.000
Selenium	0.000	0.000
Silver	0.000	0.000
Thallium	0.000	0.000
*Zinc	0.000	0.000
*Ammonia (as N)	0.000	0.000

(h) Leaching BAT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver from silver produced from leaching		
Antimony	0.166	0.074
Arsenic	0.120	0.053
Cadmium	0.017	0.007
Chromium	0.032	0.013
*Copper	0.110	0.052
Lead	0.024	0.011
Nickel	0.047	0.032
Selenium	0.071	0.032
Silver	0.025	0.010
Thallium	0.120	0.052
*Zinc	0.088	0.036
*Ammonia (as N)	11.460	5.040

*Regulated Pollutant

TABLE X-4 (Continued)

BAT EFFLUENT LIMITATIONS FOR THE SECONDARY SILVER SUBCATEGORY

(i) Leaching Wet Air Pollution Control and Precipitation of Nonphotographic Solutions Wet Air Pollution Control BAT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver from silver produced from leaching of silver		
Antimony	8.550	3.810
Arsenic	6.158	2.747
Cadmium	0.886	0.354
Chromium	1.639	0.665
*Copper	5.670	2.702
Lead	1.240	0.576
Nickel	2.437	1.639
Selenium	3.633	1.639
Silver	1.285	0.532
Thallium	6.202	2.702
*Zinc	4.519	1.861
*Ammonia (as N)	590.500	259.600

(j) Precipitation and Filtration of Nonphotographic Solutions BAT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver precipitated		
Antimony	5.925	2.640
Arsenic	4.267	1.903
Cadmium	0.614	0.246
Chromium	1.136	0.461
*Copper	3.930	1.873
Lead	0.860	0.399
Nickel	1.689	1.136
Selenium	2.517	1.136
Silver	0.890	0.399
Thallium	4.298	1.873
*Zinc	3.131	1.289
*Ammonia (as N)	409.200	179.900

*Regulated Pollutant

TABLE X-4 (Continued)

BAT EFFLUENT LIMITATIONS FOR THE SECONDARY SILVER SUBCATEGORY

(k) Floor and Equipment Washdown Water BAT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/troy ounce of silver production	
Antimony	0.000	0.000
Arsenic	0.000	0.000
Cadmium	0.000	0.000
Chromium	0.000	0.000
*Copper	0.000	0.000
Lead	0.000	0.000
Nickel	0.000	0.000
Selenium	0.000	0.000
Silver	0.000	0.000
Thallium	0.000	0.000
*Zinc	0.000	0.000
*Ammonia (as N)	0.000	0.000

* Regulated Pollutant

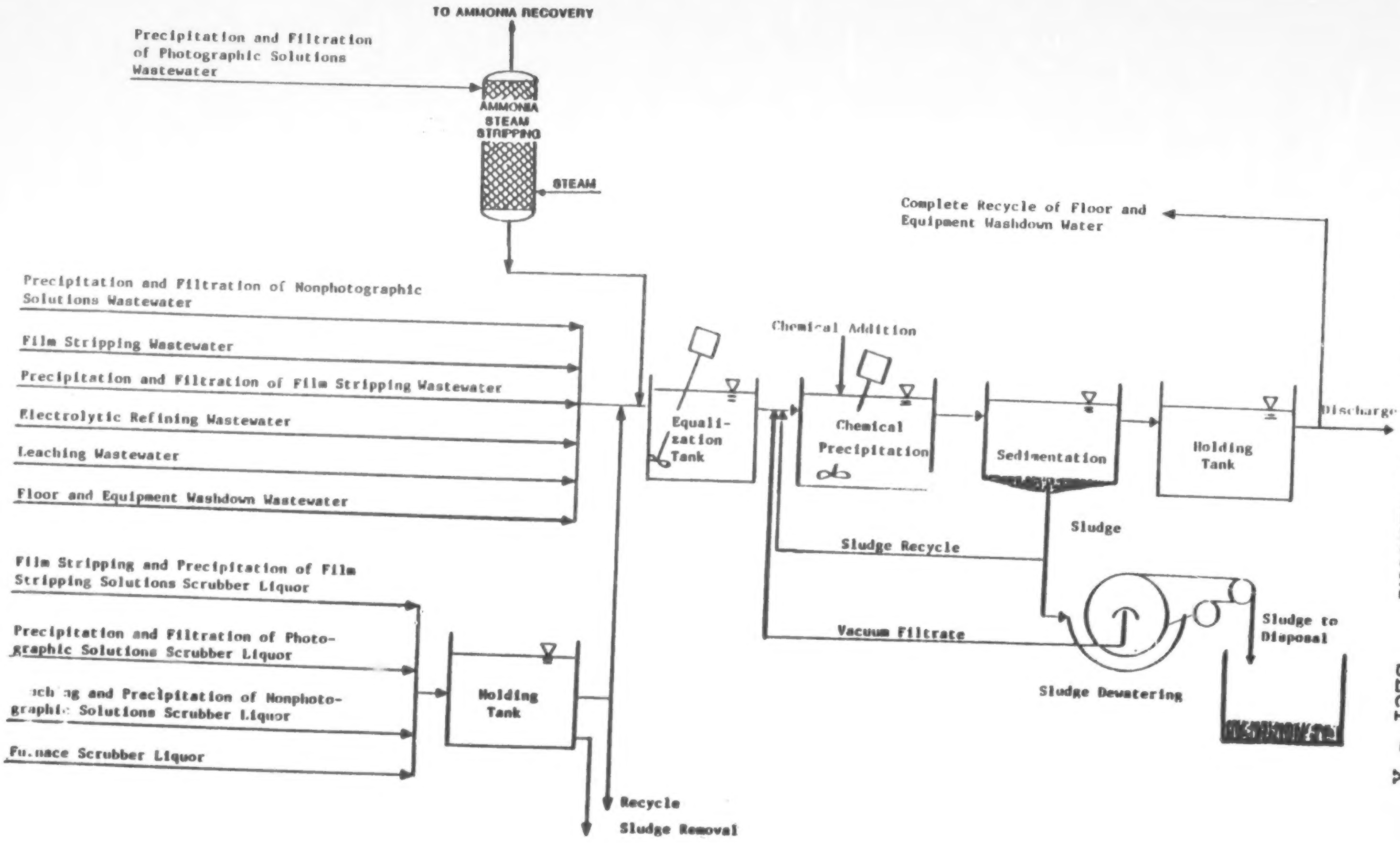
TO AMMONIA RECOVERY
Precipitation and Filtration of Photographic Solutions Wastewater
AMMONIA STEAM STRIPPING
STEAM
Complete Recycle of Floor and Equipment Washdown Water
Precipitation and Filtration of Nonphotographic Solutions Wastewater
Film Stripping Wastewater
Precipitation and Filtration of Film Stripping Wastewater
Electrolytic Refining Wastewater
Leaching Wastewater
Floor and Equipment Washdown Wastewater
Equalization Tank
Chemical Addition
Chemical Precipitation
Sedimentation
Holding Tank
Discharge
Sludge
Sludge Recycle
Vacuum Filtrate
Sludge Dewatering
Sludge to Disposal
Film Stripping and Precipitation of Film Stripping Solutions Scrubber Liquor
Precipitation and Filtration of Photographic Solutions Scrubber Liquor
Leaching and Precipitation of Nonphotographic Solutions Scrubber Liquor
Furnace Scrubber Liquor
Holding Tank
Recycle
Sludge Removal

Figure X-1

BAT TREATMENT SCHEME OPTION A
SECONDARY SILVER SUBCATEGORY

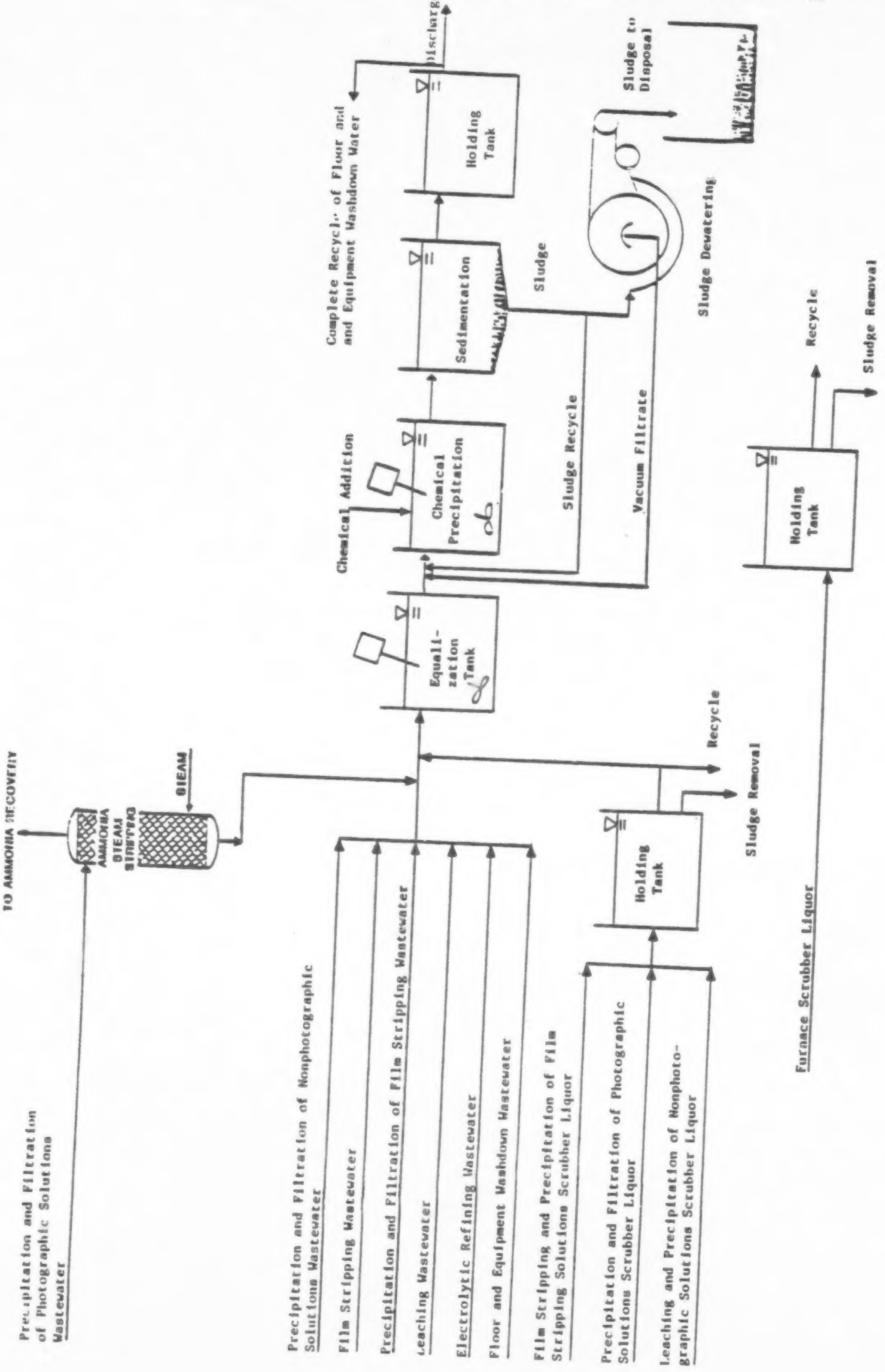
Precipitation and Filtration of Photographic Solutions Wastewater
TO AMMONIA RECOVERY
AMMONIA STEAM STRIPPING
STEAM
Precipitation and Filtration of Nonphotographic Solutions Wastewater
Film Stripping Wastewater
Precipitation and Filtration of Film Stripping Wastewater
Leaching Wastewater
Electrolytic Refining Wastewater
Floor and Equipment Washdown Wastewater
Film Stripping and Precipitation of Film Stripping Solutions Scrubber Liquor
Precipitation and Filtration of Photographic Solutions Scrubber Liquor
Leaching and Precipitation of Nonphotographic Solutions Scrubber Liquor
Holding Tank
Recycle
Sludge Removal
Equalization Tank
Chemical Addition
Chemical Precipitation
Sludge Recycle
Vacuum Filtrate
Sedimentation
Sludge
Sludge Dewatering
Complete Recycle of Floor and and Equipment Washdown Water
Holding Tank
Discharge
Sludge to Disposal
Furnace Scrubber Liquor
Holding Tank
Recycle
Sludge Removal

Figure X-2

BAT TREATMENT SCHEME OPTION B
SECONDARY SILVER SUBCATEGORY

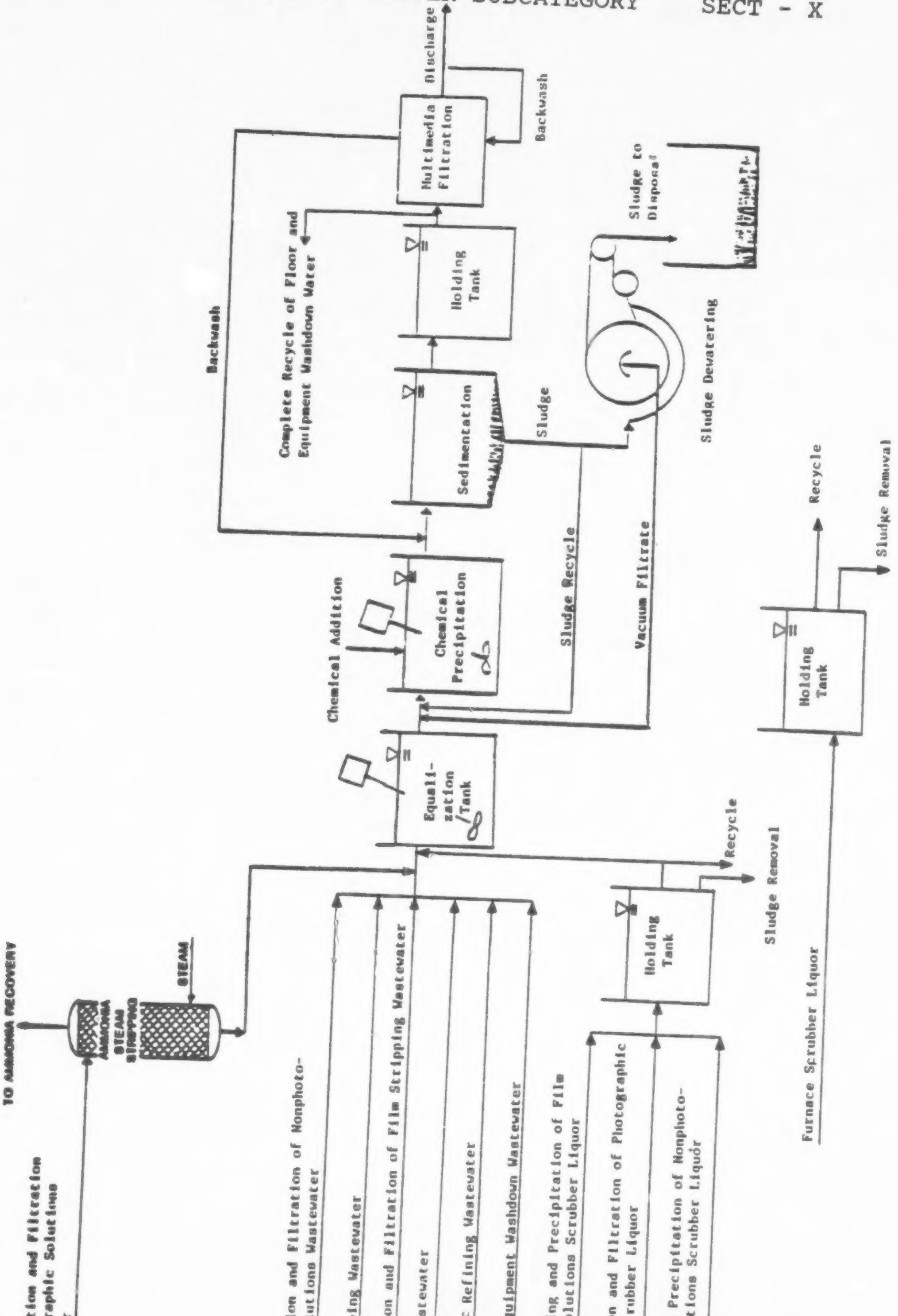
Precipitation and Filtration of Photographic Solutions Wastewater
TO AMMONIA RECOVERY
AMMONIA STEAM STRIPPING
STEAM
Precipitation and Filtration of Nonphotographic Solutions Wastewater
Film Stripping Wastewater
Precipitation and Filtration of Film Stripping Wastewater
Leaching Wastewater
Electrolytic Refining Wastewater
Floor and Equipment Washdown Wastewater
Film Stripping and Precipitation of Film Stripping Solutions Scrubber Liquor
Precipitation and Filtration of Photographic Solutions Scrubber Liquor
Leaching and Precipitation of Nonphotographic Solutions Scrubber Liquor
Holding Tank
Sludge Removal
Recycle
Equalization Tank
Chemical Addition
Chemical Precipitation
Sludge Recycle
Vacuum Filtrate
Backwash
Sedimentation
Sludge
Complete Recycle of Floor and Equipment Washdown Water
Holding Tank
Multimedia Filtration
Discharge
Backwash
Sludge Dewatering
Sludge to Disposal
Furnace Scrubber Liquor
Holding Tank
Recycle
Sludge Removal

Figure X-3

BAT TREATMENT SCHEME OPTION C SECONDARY SILVER SUBCATEGORY

SECTION XI

NEW SOURCE PERFORMANCE STANDARDS

This section describes the control technology for treatment of wastewater from new sources and presents mass discharge limitations of regulatory pollutants for NSPS in the secondary silver subcategory based on the described control technology. New plants have the opportunity to design the best and most efficient production processes and wastewater treatment technologies, without facing the added costs and restrictions encountered in retrofitting an existing plant.

TECHNICAL APPROACH TO BDT

All of the treatment technology options applicable to a ne source were previously considered for the BAT options. For this reason, three options were considered for BDT after proposal, all identical to the BAT options discussed in Section X.

Treatment and control technologies used for the BDT options are:

OPTION A

- Preliminary treatment for precipitation and filtration of photographic solutions wastewater with ammonia steam stripping concentrations
- Chemical precipitation and sedimentation
- Complete recycle of floor and equipment washdown wastewater after treatment

OPTION B

- In-process flow reduction of wet air pollution control water
- Preliminary treatment for precipitation and filtration of photographic solutions wastewater with ammonia steam stripping
- Chemical precipitation and sedimentation
- Complete recycle of floor and equipment washdown wastewater after treatment

OPTION C

- In-process flow reduction of wet air pollution control water
- Preliminary treatment for precipitation and filtration of photographic solutions wastewater with ammonia steam stripping
- Chemical precipitation and sedimentation
- Complete recycle of floor and equipment washdown wastewater after treatment
- Multimedia filtration

Partial or complete recycle and reuse of wastewater is an essential part of all three options. Recycle and reuse can precede or follow end-of-pipe treatment. A more detailed discussion of the treatment options is presented in Section X.

BDT OPTION SELECTION

EPA is promulgating a best available demonstrated technology for the secondary silver subcategory equal to Option C (in-process flow reduction, preliminary treatment with ammonia steam stripping, lime precipitation, sedimentation, and multimedia filtration end-of-pipe treatment with complete recycle of treated floor and equipment washdown wastewater). This technology is equivalent to the proposed NSPS technology (although flow allowances for casting and casting wet air pollution have been eliminated, as explained earlier). The Agency recognizes that new sources have the opportunity to implement more advanced levels of treatment without incurring the costs of retrofitting and the costs of partial or complete shutdown necessary for installation of the new equipment that existing plants should have. Review of the subcategory indicates that no new demonstrated technologies that improve on BAT exist.

Activated carbon adsorption technology (Option E) was eliminated; it is not necessary since toxic organic pollutants are not selected for limitation in this subcategory. (Refer to the discussion of exclusion of toxic organic pollutants in Sections VI and X.)

Dry scrubbing is not demonstrated for controlling emissions from film stripping, precipitation and filtration of film stripping solutions, precipitation and filtration of photographic solutions, reduction furnaces, leaching and precipitation and filtration. The nature of these emissions (acidic fumes, hot particulate matter) technically precludes the use of dry scrubbers.

Therefore, EPA is including an allowance for these sources at NSPS equivalent to that promulgated for BAT Option C. The Agency also does not believe that new plants could achieve any additional flow reduction beyond that proposed for BAT.

REGULATED POLLUTANT PARAMETERS

The Agency has no reason to believe that the pollutants that will be found in treatable concentrations in processes within new sources will be any different than with existing sources. Accordingly, pollutants and pollutant parameters selected for limitation under NSPS, in accordance with the rationale of Section VI and X, are identical to those selected for BAT. The conventional pollutant parameters TSS and pH are also selected for limitation.

NEW SOURCE PERFORMANCE STANDARDS

The NSPS discharge flows for each wastewater source are the same as the discharge rates for BAT and are listed in Table XI-1 (page 2824). The mass of pollutant allowed to be discharged per mass of product is calculated by multiplying the appropriate effluent concentration by the production normalized wastewater discharge flows (l/troy ounce). New source performance standards are presented in Table XI-2 (page 2826).

Table XI-1

NSPS WASTEWATER DISCHARGE RATES FOR THE SECONDARY SILVER SUBCATEGORY

Wastewater Stream	NSPS Normalized Discharge Rate l/troy ounce	Production Normalizing Parameter
Film stripping	50.35	troy ounces of silver produced from film stripping
Film stripping wet air pollution control and precipitation and filtration of film stripping solutions wet air pollution control	0.97	troy ounces of silver produced from precipitation and filtration of film stripping solutions
Precipitation and filtration of film stripping solutions	57.57	troy ounces of silver precipitated
Precipitation and filtration of photographic solutions	26.6	troy ounces of silver precipitated
Precipitation and filtration of photographic solutions wet air pollution control	12.14	troy ounces of silver precipitated
Electrolytic refining	0.76	troy ounces of silver refined
Furnace wet air pollution control	0	troy ounces of silver smelted, roasted, or dried

Table XI-1 (Continued)

NSPS WASTEWATER DISCHARGE RATES FOR THE SECONDARY SILVER SUBCATEGORY

Wastewater Stream	NSPS Normalized Discharge Rate 1/troy ounce	Production Normalizing Parameter
Leaching	0.086	troy ounces of silver produced from leaching
Leaching wet air pollution control and precipitation of nonphotographic solutions wet air pollution control	4.43	troy ounces of silver produced from leaching or precipitation
Precipitation and filtration of nonphotographic solutions	3.07	troy ounces of silver precipitated
Floor and equipment washdown wastewater	0	troy ounces of silver produced

TABLE XI-2

NSPS EFFLUENT LIMITATIONS FOR THE SECONDARY SILVER SUBCATEGORY

(a) Film Stripping NSPS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver from film stripping		
Antimony	97.180	43.300
Arsenic	69.990	31.220
Cadmium	10.070	4.028
Chromium	18.630	7.553
*Copper	64.450	30.710
Lead	14.100	6.546
Nickel	27.690	18.630
Selenium	41.290	18.630
Silver	14.600	6.042
Thallium	70.490	30.710
*Zinc	51.360	21.150
*Ammonia (as N)	6712.000	2951.000
*TSS	755.300	604.200
*pH	Within the range of 7.5 to 10.0 at all times	

(b) Film Stripping Wet Air Pollution Control and Precipitation and Filtration of Film Stripping Solutions Wet Air Pollution Control NSPS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver from precipitation and filtration of film stripping solutions		
Antimony	1.872	0.834
Arsenic	1.348	0.601
Cadmium	0.194	0.078
Chromium	0.359	0.146
*Copper	1.242	0.592
Lead	0.272	0.126
Nickel	0.534	0.359
Selenium	0.795	0.359
Silver	0.281	0.116
Thallium	1.358	0.592
*Zinc	0.989	0.407
*Ammonia (as N)	129.300	56.840
*TSS	14.550	11.640
*pH	Within the range of 7.5 to 10.0 at all times	

*Regulated Pollutant

TABLE XI-2 (Continued)

NSPS EFFLUENT LIMITATIONS FOR THE SECONDARY SILVER SUBCATEGORY

(c) Precipitation and Filtration of Film Stripping Solutions NSPS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/troy ounce of silver precipitated	
Antimony	111.100	49.510
Arsenic	80.020	35.690
Cadmium	11.510	4.606
Chromium	21.300	8.636
*Copper	73.690	35.120
Lead	16.120	7.484
Nickel	31.660	21.300
Selenium	47.210	21.300
Silver	16.700	6.908
Thallium	80.600	35.120
*Zinc	58.720	24.180
*Ammonia (as N)	7674.000	3374.000
*TSS	863.600	690.800
*pH	Within the range of 7.5 to 10.0 at all times	

(d) Precipitation and Filtration of Photographic Solutions NSPS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/troy ounce of silver precipitated	
Antimony	51.340	22.880
Arsenic	36.970	16.490
Cadmium	5.320	2.128
Chromium	9.842	3.990
*Copper	34.050	16.230
Lead	7.448	3.458
Nickel	14.630	9.842
Selenium	21.810	9.842
Silver	7.714	3.192
Thallium	37.240	16.230
*Zinc	27.130	11.170
*Ammonia (as N)	3546.000	1559.000
*TSS	399.000	319.200
*pH	Within the range of 7.5 to 10.0 at all times	

*Regulated Pollutant

TABLE XI-2 (Continued)

NSPS EFFLUENT LIMITATIONS FOR THE SECONDARY SILVER SUBCATEGORY

(e) Precipitation and Filtration of Photographic Solutions Wet Air Pollution Control NSPS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver from precipitation and filtration of photographic solutions		
Antimony	23.430	10.440
Arsenic	16.880	7.527
Cadmium	2.428	0.971
Chromium	4.492	1.821
*Copper	15.540	7.405
Lead	3.399	1.578
Nickel	6.677	4.492
Selenium	9.955	4.492
Silver	3.521	1.457
Thallium	17.000	7.405
*Zinc	12.380	5.099
*Ammonia (as N)	1618.000	711.400
*TSS	182.100	145.700
*pH	Within the range of 7.5 to 10.0 at all times	

(f) Electrolytic Refining NSPS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver from electrolytic refining		
Antimony	1.467	0.654
Arsenic	1.056	0.471
Cadmium	0.152	0.061
Chromium	0.281	0.114
*Copper	0.973	0.464
Lead	0.213	0.099
Nickel	0.418	0.281
Selenium	0.623	0.281
Silver	0.220	0.091
Thallium	1.064	0.464
*Zinc	0.775	0.319
*Ammonia (as N)	101.300	44.540
*TSS	11.400	9.120
*pH	Within the range of 7.5 to 10.0 at all times	

*Regulated Pollutant

TABLE XI-2 (Continued)

NSPS EFFLUENT LIMITATIONS FOR THE SECONDARY SILVER SUBCATEGORY

(g) Furnace Wet Air Pollution Control NSPS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver from silver roasted, smelted, or dried		
Antimony	0.000	0.000
Arsenic	0.000	0.000
Cadmium	0.000	0.000
Chromium	0.000	0.000
*Copper	0.000	0.000
Lead	0.000	0.000
Nickel	0.000	0.000
Selenium	0.000	0.000
Silver	0.000	0.000
Thallium	0.000	0.000
*Zinc	0.000	0.000
*Ammonia (as N)	0.000	0.000
*TSS	0.000	0.000
*pH	Within the range of 7.5 to 10.0 at all times	

(h) Leaching NSPS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver from silver produced from leaching		
Antimony	0.166	0.074
Arsenic	0.120	0.053
Cadmium	0.017	0.007
Chromium	0.032	0.013
*Copper	0.110	0.052
Lead	0.024	0.011
Nickel	0.047	0.032
Selenium	0.071	0.032
Silver	0.025	0.010
Thallium	0.120	0.052
*Zinc	0.088	0.036
*Ammonia (as N)	11.460	5.040
*TSS	1.290	1.032
*pH	Within the range of 7.5 to 10.0 at all times	

*Regulated Pollutant

TABLE XI-2 (Continued)

NSPS EFFLUENT LIMITATIONS FOR THE SECONDARY SILVER SUBCATEGORY

(i) Leaching Wet Air Pollution Control and Precipitation of Nonphotographic Solutions Wet Air Pollution Control NSPS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver from silver produced from leaching of silver		
Antimony	8.550	3.810
Arsenic	6.158	2.747
Cadmium	0.886	0.354
Chromium	1.639	0.665
*Copper	5.670	2.702
Lead	1.240	0.576
Nickel	2.437	1.639
Selenium	3.633	1.639
Silver	1.285	0.532
Thallium	6.202	2.702
*Zinc	4.519	1.861
*Ammonia (as N)	590.500	259.600
*TSS	66.450	53.160
*pH	Within the range of 7.5 to 10.0 at all times	

(j) Precipitation and Filtration of Nonphotographic Solutions NSPS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver precipitated		
Antimony	5.925	2.640
Arsenic	4.267	1.903
Cadmium	0.614	0.246
Chromium	1.136	0.461
*Copper	3.930	1.873
Lead	0.860	0.399
Nickel	1.689	1.136
Selenium	2.517	1.136
Silver	0.890	0.399
Thallium	4.298	1.873
*Zinc	3.131	1.289
*Ammonia (as N)	409.200	179.900
*TSS	46.050	36.840
*pH	Within the range of 7.5 to 10.0 at all times	

*Regulated Pollutant

TABLE XI-2 (Continued)

NSPS EFFLUENT LIMITATIONS FOR THE SECONDARY SILVER SUBCATEGORY

(k) Floor and Equipment Washdown Water NSPS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/troy ounce of silver production	
Antimony	0.000	0.000
Arsenic	0.000	0.000
Cadmium	0.000	0.000
Chromium	0.000	0.000
*Copper	0.000	0.000
Lead	0.000	0.000
Nickel	0.000	0.000
Selenium	0.000	0.000
Silver	0.000	0.000
Thallium	0.000	0.000
*Zinc	0.000	0.000
*Ammonia (as N)	0.000	0.000
*TSS	0.000	0.000
*pH	Within the range of 7.5 to 10.0 at all times	

*Regulated Pollutant

SECTION XII

PRETREATMENT STANDARDS

This section describes the control and treatment technologies for pretreatment of process wastewaters from existing sources and new sources in the secondary silver subcategory. Pretreatment standards for regulated pollutants are presented based on the selected control and treatment technologies.

PSES are designed to prevent the discharge of pollutants which pass through, interfere with, or are otherwise incompatible with the operation of publicly owned treatment works (POTW). The Clean Water Act of 1977 requires pretreatment for pollutants, such as toxic metals, that limit POTW sludge management alternatives. New indirect discharge facilities, like new direct discharge facilities, have the opportunity to incorporate the best available demonstrated technologies, including process changes, in-plant controls, and end-of-pipe treatment technologies, and to use plant site selection to ensure adequate treatment system installation. Pretreatment standards are to be technology based, analogous to the best available technology for removal of toxic pollutants.

TECHNICAL APPROACH TO PRETREATMENT

Before proposing pretreatment standards, the Agency examines whether the pollutants discharged by the industry pass through the POTW or interfere with the POTW operation or its chosen sludge disposal practices. In determining whether pollutants pass through a well-operated POTW, achieving secondary treatment, the Agency compares the percentage of a pollutant removed by POTW with the percentage removed by direct dischargers applying the best available technology economically achievable. A pollutant is deemed to pass through the POTW when the average percentage removed nationwide by well-operated POTW meeting secondary treatment requirements, is less than the percentage removed by direct dischargers complying with BAT effluent limitations guidelines for that pollutant. (See generally, 46 FR at 9415-16 (January 28, 1981).)

This definition of pass through satisfies two competing objectives set by Congress: (1) that standards for indirect dischargers be equivalent to standards for direct dischargers, while at the same time, (2) that the treatment capability and performance of the POTW be recognized and taken into account in regulating the discharge of pollutants from indirect dischargers. The Agency compares percentage removal rather than the mass or concentration of pollutants discharged because the latter would not take into account the mass of pollutants discharged to the POTW from non-industrial sources nor the dilution of the pollutants in the POTW effluent to lower concentrations due to the addition of large amounts of non-industrial wastewater.

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PRETREATMENT STANDARDS FOR EXISTING AND NEW SOURCES

Options for pretreatment of wastewaters are based on increasing the effectiveness of end-of-pipe treatment technologies. All in-plant changes and applicable end-of-pipe treatment processes have been discussed previously in Sections X and XI. The options for PSES and PSNS, therefore, are the same as the BAT options discussed in Section X.

A description of each option is presented in Section X, while a more detailed discussion, including pollutants controlled by each treatment process and achievable treatment concentration for each option, is presented in Section VII of Vol. I.

Treatment technology used for the PSES and PSNS options are:

OPTION A

- Preliminary treatment for precipitation and filtration of photographic solutions wastewater with ammonia steam stripping
- Chemical precipitation and sedimentation
- Complete recycle of floor and equipment washdown wastewater after treatment

OPTION B

- In-process flow reduction of wet air pollution control water
- Preliminary treatment for precipitation and filtration of photographic solutions wastewater with ammonia steam stripping
- Chemical precipitation and sedimentation
- Complete recycle of floor and equipment washdown wastewater after treatment

OPTION C

- In-process flow reduction of wet air pollution control water
- Preliminary treatment for precipitation and filtration of photographic solutions wastewater with ammonia steam stripping
- Chemical precipitation and sedimentation
- Complete recycle of floor and equipment washdown wastewater after treatment
- Multimedia filtration

INDUSTRY COST AND POLLUTANT REMOVAL ESTIMATES

The industry cost and pollutant removal estimates of each treatment option were used to determine the most cost-effective option. The methodology applied in calculating pollutant removal estimates and plant compliance costs is discussed in Section X.

Table XII-1 (page 2837) shows the estimated pollutant removals for indirect dischargers, while compliance costs for indirect discharges are presented in Table VIII-2 (page 2838).

PSES OPTION SELECTION - PROPOSAL

At proposal, EPA selected in-process flow reduction, ammonia steam stripping preliminary treatment, lime precipitation, and sedimentation (Option B) and in-process flow reduction, ammonia steam stripping preliminary treatment, chemical precipitation, sedimentation, and multimedia filtration (Option C) as alternative pretreatment standards for existing sources for this subcategory. This selection follows from the rationale used in selecting alternative options as the basis for BAT. (Refer to Section X.)

Activated carbon adsorption technology (Option E) was eliminated because it is not necessary since toxic organic pollutants are not selected for limitation in this subcategory. (Refer to the discussion of selection of pollutants for limitation in Section X.)

PSES OPTION SELECTION - PROMULGATION

EPA is promulgating PSES equal to promulgated BAT for this subcategory. The technology basis for PSES thus is lime precipitation and sedimentation, ammonia steam stripping, wastewater flow reduction, and filtration. Flow reduction for the selected technology represents a 23 percent reduction in flow over current discharge rates.

Based on revised calculations, EPA estimates that implementation of the promulgated PSES limitations would remove annually an estimated 4,259 kg of toxic pollutants and 42,900 kg of ammonia over estimated raw discharge. The final PSES effluent mass limitations will remove 13 kg/yr of toxic metals over the intermediate PSES option considered, which lacks filtration. Both options are economically achievable. The Agency believes the incremental removal justifies selection of filtration as part of PSES model technology. Filtration is currently demonstrated by eight indirect discharging secondary silver plants. Capital cost for achieving proposed PSES is $634,000 (March, 1982 dollars), and annual cost of $422,000 (March, 1982 dollars).

PSNS OPTION SELECTION

EPA has selected in-process flow reduction, preliminary treatment with ammonia steam stripping, lime precipitation, sedimentation, complete recycle of treated floor and equipment washdown wastewater, and multimedia filtration (Option C) as the technology basis for PSNS. The Agency recognizes that new sources have the opportunity to implement more advanced levels of treatment without incurring the costs of retrofitting and the costs of partial or complete shutdown necessary for installation of the new equipment that existing plants should have.

EPA has not identified any demonstrated technology that provides more efficient pollutant removal than PSNS technology. No additional flow reduction for new sources is feasible because dry scrubbing is not demonstrated for controlling emissions from film stripping, precipitation and filtration of photographic solutions, reduction furnaces, leaching and precipitation and filtration. The nature of these emissions (acidic fumes, hot particulate matter) technically precludes the use of dry scrubbers. Since PSNS does not include any additional costs compared to NSPS, the Agency does not believe PSNS will be a barrier to entry for new facilities.

REGULATED POLLUTANT PARAMETERS

Pollutants and pollutant parameters selected for limitation for PSES and PSNS, in accordance with the rationale of Section VI and X, are identical to those selected for limitation for BAT. EPA is proposing PSNS for copper, zinc, and ammonia to prevent pass-through. The conventional pollutants, TSS and pH, are not limited under PSES and PSNS because they are effectively controlled by POTW.

PRETREATMENT STANDARDS

The PSES and PSNS discharge flows are identical to the BAT discharge flows for all processes. These discharge flows are listed in Table XII-2 (page 2838). The mass of pollutant allowed to be discharged per mass of product is calculated by multiplying the achievable treatment concentration (mg/l) by the normalized wastewater discharge flow (l/troy ounce). Pretreatment standards for existing and new sources, as determined from the above procedure, are shown in Tables XII-3 and XII-4 (pages 2840 and 2846) for each waste stream.

Mass-based standards are promulgated for the secondary silver subcategory to ensure that the standards are achieved by means of pollutant removal rather than by dilution. They are particularly important since the standards are based upon flow reduction. Pollutant limitations associated with flow reduction cannot be measured any way but as a reduction of mass discharged. Mass-based PSES without alternative concentration-based standards are promulgated in this subcategory, although the flow reduction for the entire subcategory is not great. However, several plants grossly exceed the flow basis of PSES. Mass-based standards are needed to ensure that these plants reduce their water usage. Mass-based PSNS are promulgated in this subcategory because PSNS for secondary silver is based on 99 percent flow reduction of raw wastewater by recycle, and new plants would lack incentive to achieve these reductions without a mass-based standard.

Table XII-1

POLLUTANT REMOVAL ESTIMATES FOR SECONDARY SILVER INDIRECT DISCHARGERS

POLLUTANT	TOTAL RAW WASTE (kg/yr)	OPTION A DISCHARGED (kg/yr)	OPTION A REMOVED (kg/yr)	OPTION B DISCHARGED (kg/yr)	OPTION B REMOVED (kg/yr)	OPTION C DISCHARGED (kg/yr)	OPTION C REMOVED (kg/yr)
Arsenic	2.1	2.1	0.0	2.1	0.0	2.1	0.0
Antimony	7.8	7.8	0.0	7.8	0.0	7.8	0.0
Cadmium	11.6	1.5	10.1	1.5	10.1	0.9	10.7
Chromium	34.0	1.6	32.4	1.6	32.4	1.4	32.7
Lead	59.4	2.3	57.1	2.3	57.1	1.5	57.9
Nickel	129.1	14.3	114.8	14.3	114.8	4.2	124.8
Selenium	441.0	5.8	435.2	5.8	435.2	3.9	437.2
Silver	7.3	1.9	5.3	1.9	5.3	1.4	5.9
Thallium	1.2	1.2	0.0	1.2	0.0	1.2	0.0
Copper	184.7	11.2	173.5	11.2	173.5	7.5	177.2
Zinc	3,417.2	6.4	3,410.8	6.4	3,410.8	4.4	3,412.8
TOTAL TOXIC METALS	4,295.5	56.2	4,239.3	56.2	4,239.3	36.4	4,259.1
Ammonia	43,519.2	618.0	42,901.2	618.0	42,901.2	618.0	42,901.2
TOTAL NONCONVENTIONALS	43,519.2	618.0	42,901.2	618.0	42,901.2	618.0	42,901.2
TSS	13,602.8	231.8	13,371.0	231.8	13,371.0	50.2	13,552.6
TOTAL CONVENTIONALS	13,602.8	231.8	13,371.0	231.8	13,371.0	50.2	13,552.6
TOTAL POLLUTANTS	61,417.5	906.0	60,511.6	906.0	60,511.6	704.6	60,712.9
FLOW (l/yr)		19,313,320		19,313,320		19,313,320	

NOTE: TOTAL TOXIC METALS = Arsenic + Antimony + Cadmium + Chromium + Lead + Nickel + Selenium + Silver + Thallium + Copper + Zinc

TOTAL NONCONVENTIONALS = Ammonia

TOTAL CONVENTIONALS = TSS

TOTAL POLLUTANTS = Total Toxic Metals + Total Nonconventionals + Total Conventionals

OPTION A = Ammonia Steam Stripping, Lime Precipitation, and Sedimentation

OPTION B = Option A, plus In-Process Flow Reduction

OPTION C = Option B, plus Multimedia Filtration

Table XII-2

PSES AND PSNS WASTEWATER DISCHARGE RATES FOR THE SECONDARY SILVER SUBCATEGORY

Wastewater Stream	PSES and PSNS Normalized Discharge Rate l/troy ounce	Production Normalizing Parameter
Film stripping	50.35	troy ounces of silver produced from film stripping
Film stripping wet air pollution control and precipitation and filtration of film stripping solutions wet air pollution control	0.97	troy ounces of silver produced from precipitation and filtration of film stripping solutions
Precipitation and filtration of film stripping solutions	57.57	troy ounces of silver precipitated
Precipitation and filtration of photographic solutions	26.6	troy ounces of silver precipitated
Precipitation and filtration of photographic solutions wet air pollution control	12.14	troy ounces of silver precipitated
Electrolytic refining	0.76	troy ounces of silver refined
Furnace wet air pollution control	0	troy ounces of silver smelted, roasted, or dried

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Table XII-2 (Continued)

PSES AND PSNS WASTEWATER DISCHARGE RATES FOR THE SECONDARY SILVER SUBCATEGORY

Wastewater Stream	PSES and PSNS Normalized Discharge Rate 1/troy ounce	Production Normalizing Parameter
Leaching	0.086	troy ounces of silver produced from leaching
Leaching wet air pollution control and precipitation of nonphotographic solutions wet air pollution control	4.43	troy ounces of silver produced from leaching or precipitation
Precipitation and filtration of nonphotographic solutions	3.07	troy ounces of silver precipitated
Floor and equipment washdown wastewater	0	troy ounces of silver produced

TABLE XII-3

PSES EFFLUENT LIMITATIONS FOR THE SECONDARY SILVER SUBCATEGORY

(a) Film Stripping PSES

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver from film stripping		
Antimony	97.180	43.300
Arsenic	69.990	31.220
Cadmium	10.070	4.028
Chromium	18.630	7.553
*Copper	64.450	30.710
Lead	14.100	6.546
Nickel	27.690	18.630
Selenium	41.290	18.630
Silver	14.600	6.042
Thallium	70.490	30.710
*Zinc	51.360	21.150
*Ammonia (as N)	6712.000	2951.000

(b) Film Stripping Wet Air Pollution Control and Precipitation and Filtration of Film Stripping Solutions Wet Air Pollution Control PSES

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver from precipitation and filtration of film stripping solutions		
Antimony	1.872	0.834
Arsenic	1.348	0.601
Cadmium	0.194	0.078
Chromium	0.359	0.146
*Copper	1.242	0.592
Lead	0.272	0.126
Nickel	0.534	0.359
Selenium	0.795	0.359
Silver	0.281	0.116
Thallium	1.358	0.592
*Zinc	0.989	0.407
*Ammonia (as N)	129.300	56.840

*Regulated Pollutant

TABLE XII-3 (Continued)

PSES EFFLUENT LIMITATIONS FOR THE SECONDARY SILVER SUBCATEGORY

(c) Precipitation and Filtration of Film Stripping Solutions PSES

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver precipitated		
Antimony	111.100	49.510
Arsenic	80.020	35.690
Cadmium	11.510	4.606
Chromium	21.300	8.636
*Copper	73.690	35.120
Lead	16.120	7.484
Nickel	31.660	21.300
Selenium	47.210	21.300
Silver	16.700	6.908
Thallium	80.600	35.120
*Zinc	58.720	24.180
*Ammonia (as N)	7674.000	3374.000

(d) Precipitation and Filtration of Photographic Solutions PSES

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver precipitated		
Antimony	51.340	22.880
Arsenic	36.970	16.490
Cadmium	5.320	2.128
Chromium	9.842	3.990
*Copper	34.050	16.230
Lead	7.448	3.458
Nickel	14.630	9.842
Selenium	21.810	9.842
Silver	7.714	3.192
Thallium	37.240	16.230
*Zinc	27.130	11.170
*Ammonia (as N)	3546.000	1559.000

*Regulated Pollutant

TABLE XII-3 (Continued)

PSES EFFLUENT LIMITATIONS FOR THE SECONDARY SILVER SUBCATEGORY

(e) Precipitation and Filtration of Photographic Solutions Wet Air Pollution Control PSES

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver from precipitation and filtration of photographic solutions		
Antimony	23.430	10.440
Arsenic	16.880	7.527
Cadmium	2.428	0.971
Chromium	4.492	1.821
*Copper	15.540	7.405
Lead	3.399	1.578
Nickel	6.677	4.492
Selenium	9.955	4.492
Silver	3.521	1.457
Thallium	17.000	7.405
*Zinc	12.380	5.099
*Ammonia (as N)	1618.000	711.400

(f) Electrolytic Refining PSES

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver from electrolytic refining		
Antimony	1.467	0.654
Arsenic	1.056	0.471
Cadmium	0.152	0.061
Chromium	0.281	0.114
*Copper	0.973	0.464
Lead	0.213	0.099
Nickel	0.418	0.281
Selenium	0.623	0.281
Silver	0.220	0.091
Thallium	1.064	0.464
*Zinc	0.775	0.319
*Ammonia (as N)	101.300	44.540

*Regulated Pollutant

TABLE XII-3 (Continued)

PSES EFFLUENT LIMITATIONS FOR THE SECONDARY SILVER SUBCATEGORY

(g) Furnace Wet Air Pollution Control PSES

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver from silver roasted, smelted, or dried		
Antimony	0.000	0.000
Arsenic	0.000	0.000
Cadmium	0.000	0.000
Chromium	0.000	0.000
*Copper	0.000	0.000
Lead	0.000	0.000
Nickel	0.000	0.000
Selenium	0.000	0.000
Silver	0.000	0.000
Thallium	0.000	0.000
*Zinc	0.000	0.000
*Ammonia (as N)	0.000	0.000

(h) Leaching PSES

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver from silver produced from leaching		
Antimony	0.166	0.074
Arsenic	0.120	0.053
Cadmium	0.017	0.007
Chromium	0.032	0.013
*Copper	0.110	0.052
Lead	0.024	0.011
Nickel	0.047	0.032
Selenium	0.071	0.032
Silver	0.025	0.010
Thallium	0.120	0.052
*Zinc	0.088	0.036
*Ammonia (as N)	11.460	5.040

*Regulated Pollutant

TABLE XII-3 (Continued)

PSES EFFLUENT LIMITATIONS FOR THE SECONDARY SILVER SUBCATEGORY

(i) Leaching Wet Air Pollution Control and Precipitation of Nonphotographic Solutions Wet Air Pollution Control PSES

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver from silver produced from leaching or silver		
Antimony	8.550	3.810
Arsenic	6.158	2.747
Cadmium	0.886	0.354
Chromium	1.639	0.665
*Copper	5.670	2.702
Lead	1.240	0.576
Nickel	2.437	1.639
Selenium	3.633	1.639
Silver	1.285	0.532
Thallium	6.202	2.702
*Zinc	4.519	1.861
*Ammonia (as N)	590.500	259.600

(j) Precipitation and Filtration of Nonphotographic Solutions PSES

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver precipitated		
Antimony	5.925	2.640
Arsenic	4.267	1.903
Cadmium	0.614	0.246
Chromium	1.136	0.461
*Copper	3.930	1.873
Lead	0.860	0.399
Nickel	1.689	1.136
Selenium	2.517	1.136
Silver	0.890	0.399
Thallium	4.298	1.873
*Zinc	3.131	1.289
*Ammonia (as N)	409.200	179.900

*Regulated Pollutant

TABLE XII-3 (Continued)

PSES EFFLUENT LIMITATIONS FOR THE SECONDARY SILVER SUBCATEGORY

(k) Floor and Equipment Washdown Water PSES

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver production		
Antimony	0.000	0.000
Arsenic	0.000	0.000
Cadmium	0.000	0.000
Chromium	0.000	0.000
*Copper	0.000	0.000
Lead	0.000	0.000
Nickel	0.000	0.000
Selenium	0.000	0.000
Silver	0.000	0.000
Thallium	0.000	0.000
*Zinc	0.000	0.000
*Ammonia (as N)	0.000	0.000

TABLE XII-4

PSNS EFFLUENT LIMITATIONS FOR THE SECONDARY SILVER SUBCATEGORY

(a) Film Stripping PSNS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver from film stripping		
Antimony	97.180	43.300
Arsenic	69.990	31.220
Cadmium	10.070	4.028
Chromium	18.630	7.553
*Copper	64.450	30.710
Lead	14.100	6.546
Nickel	27.690	18.630
Selenium	41.290	18.630
Silver	14.600	6.042
Thallium	70.490	30.710
*Zinc	51.360	21.150
*Ammonia (as N)	6712.000	2951.000

(b) Film Stripping Wet Air Pollution Control and Precipitation and Filtration of Film Stripping Solutions Wet Air Pollution Control PSNS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver from precipitation and filtration of film stripping solutions		
Antimony	1.872	0.834
Arsenic	1.348	0.601
Cadmium	0.194	0.078
Chromium	0.359	0.146
*Copper	1.242	0.592
Lead	0.272	0.126
Nickel	0.534	0.359
Selenium	0.795	0.359
Silver	0.281	0.116
Thallium	1.358	0.592
*Zinc	0.989	0.407
*Ammonia (as N)	129.300	56.840

*Regulated Pollutant

TABLE XII-4 (Continued)

PSNS EFFLUENT LIMITATIONS FOR THE SECONDARY SILVER SUBCATEGORY

(c) Precipitation and Filtration of Film Stripping Solutions PSNS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver precipitated		
Antimony	111.100	49.510
Arsenic	80.020	35.690
Cadmium	11.510	4.606
Chromium	21.300	8.636
*Copper	73.690	35.120
Lead	16.120	7.484
Nickel	31.660	21.300
Selenium	47.210	21.300
Silver	16.700	6.908
Thallium	80.600	35.120
*Zinc	58.720	24.180
*Ammonia (as N)	7674.000	3374.000

(d) Precipitation and Filtration of Photographic Solutions PSNS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver precipitated		
Antimony	51.340	22.880
Arsenic	36.970	16.490
Cadmium	5.320	2.128
Chromium	9.842	3.990
*Copper	34.050	16.230
Lead	7.448	3.458
Nickel	14.630	9.842
Selenium	21.810	9.842
Silver	7.714	3.192
Thallium	37.240	16.230
*Zinc	27.130	11.170
*Ammonia (as N)	3546.000	1559.000

*Regulated Pollutant

TABLE XII-4 (Continued)

PSNS EFFLUENT LIMITATIONS FOR THE SECONDARY SILVER SUBCATEGORY

(e) Precipitation and Filtration of Photographic Solutions Wet Air Pollution Control PSNS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver from precipitation and filtration of photographic solutions		
Antimony	23.430	10.440
Arsenic	16.880	7.527
Cadmium	2.428	0.971
Chromium	4.492	1.821
*Copper	15.540	7.405
Lead	3.399	1.578
Nickel	6.677	4.492
Selenium	9.955	4.492
Silver	3.521	1.457
Thallium	17.000	7.405
*Zinc	12.380	5.099
*Ammonia (as N)	1618.000	711.400

(f) Electrolytic Refining PSNS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver from electrolytic refining		
Antimony	1.467	0.654
Arsenic	1.056	0.471
Cadmium	0.152	0.061
Chromium	0.281	0.114
*Copper	0.973	0.464
Lead	0.213	0.099
Nickel	0.418	0.281
Selenium	0.623	0.281
Silver	0.220	0.091
Thallium	1.064	0.464
*Zinc	0.775	0.319
*Ammonia (as N)	101.300	44.540

*Regulated Pollutant

TABLE XII-4 (Continued)

PSNS EFFLUENT LIMITATIONS FOR THE SECONDARY SILVER SUBCATEGORY

(g) Furnace Wet Air Pollution Control PSNS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver from silver roasted, smelted, or dried		
Antimony	0.000	0.000
Arsenic	0.000	0.000
Cadmium	0.000	0.000
Chromium	0.000	0.000
*Copper	0.000	0.000
Lead	0.000	0.000
Nickel	0.000	0.000
Selenium	0.000	0.000
Silver	0.000	0.000
Thallium	0.000	0.000
*Zinc	0.000	0.000
*Ammonia (as N)	0.000	0.000

(h) Leaching PSNS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver from silver produced from leaching		
Antimony	0.166	0.074
Arsenic	0.120	0.053
Cadmium	0.017	0.007
Chromium	0.032	0.013
*Copper	0.110	0.052
Lead	0.024	0.011
Nickel	0.047	0.032
Selenium	0.071	0.032
Silver	0.025	0.010
Thallium	0.120	0.052
*Zinc	0.088	0.036
*Ammonia (as N)	11.460	5.040

*Regulated Pollutant

TABLE XII-4 (Continued)

PSNS EFFLUENT LIMITATIONS FOR THE SECONDARY SILVER SUBCATEGORY

(i) Leaching Wet Air Pollution Control and Precipitation of Nonphotographic Solutions Wet Air Pollution Control PSNS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver from silver produced from leaching or silver		
Antimony	8.550	3.810
Arsenic	6.158	2.747
Cadmium	0.886	0.354
Chromium	1.639	0.665
*Copper	5.670	2.702
Lead	1.240	0.576
Nickel	2.437	1.639
Selenium	3.633	1.639
Silver	1.285	0.532
Thallium	6.202	2.702
*Zinc	4.519	1.861
*Ammonia (as N)	590.500	259.600

(j) Precipitation and Filtration of Nonphotographic Solutions PSNS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver precipitated		
Antimony	5.925	2.640
Arsenic	4.267	1.903
Cadmium	0.614	0.246
Chromium	1.136	0.461
*Copper	3.930	1.873
Lead	0.860	0.399
Nickel	1.689	1.136
Selenium	2.517	1.136
Silver	0.890	0.399
Thallium	4.298	1.873
*Zinc	3.131	1.289
*Ammonia (as N)	409.200	179.900

*Regulated Pollutant

TABLE XII-4 (Continued)

PSNS EFFLUENT LIMITATIONS FOR THE SECONDARY SILVER SUBCATEGORY

(k) Floor and Equipment Washdown Water PSNS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/troy ounce of silver production		
Antimony	0.000	0.000
Arsenic	0.000	0.000
Cadmium	0.000	0.000
Chromium	0.000	0.000
*Copper	0.000	0.000
Lead	0.000	0.000
Nickel	0.000	0.000
Selenium	0.000	0.000
Silver	0.000	0.000
Thallium	0.000	0.000
*Zinc	0.000	0.000
*Ammonia (as N)	0.000	0.000

*Regulated Pollutant

SECTION XIII

BEST CONVENTIONAL POLLUTANT CONTROL TECHNOLOGY

EPA is not promulgating best conventional pollutant control technology (BCT) for the secondary silver subcategory at this time.

NONFERROUS METALS MANUFACTURING POINT SOURCE CATEGORY

DEVELOPMENT DOCUMENT SUPPLEMENT

for the

Secondary Mercury Subcategory

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May 1989

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SECONDARY MERCURY SUBCATEGORY

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SECTION I

SUMMARY

This document provides the technical basis for promulgating pretreatment standards for new indirect dischargers (PSNS) and standards of performance for new source direct dischargers (NSPS). The secondary mercury subcategory is comprised of four plants. Two plants achieve zero discharge of process wastewater, and two plants do not generate process wastewater.

EPA first studied the secondary mercury subcategory to determine whether differences in raw materials, final products, manufacturing processes, equipment, age and size of plants, or water usage, required the development of separate effluent limitations and standards for different segments of the subcategory. This involved a detailed analysis of wastewater discharge and treated effluent characteristics, including the sources and volume of water used, the processes used, the sources of pollutants and wastewaters in the plant, and the constituents of wastewaters including priority pollutants. As a result, three subdivisions have been identified for this subcategory that warrant separate effluent limitations. These include:

1. Spent battery electrolyte,
2. Acid wash and rinse water, and
3. Furnace wet air pollution control.

Several distinct control and treatment technologies (both in-plant and end-of-pipe) applicable to the secondary mercury subcategory were identified. The Agency analyzed both historical and newly generated data on the performance of these technologies, including their nonwater quality environmental impacts and air quality, solid waste generation, and energy requirements. EPA also studied various flow reduction techniques reported in the data collection portfolios (dcp) and plant visits.

Engineering costs were prepared for each of the control and treatment options considered for the subcategory. These costs were then used by the Agency to estimate the impact of implementing the various options on the subcategory. For each control and treatment option that the Agency found to be effective and technically feasible in controlling the discharge of pollutants, the number of potential closures, number of employees affected, and impact on price were investigated. These results are reported in a separate document entitled "The Economic Impact Analysis of Effluent Limitations and Standards for the Nonferrous Metals Manufacturing Industry."

No plants in the secondary mercury subcategory discharge process wastewater. This is achieved by 100 percent recycle on-site or by contractor disposal of process wastewater, or is a result of a

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production process that generates no process wastewater. Therefore, BPT, BAT, BCT, and PSES are not being promulgated for this subcategory. The secondary mercury subcategory is regulated under New Source Performance Standards and Pretreatment Standards for New Sources.

After examining the various treatment technologies, the Agency has identified best demonstrated technology, which is the technical basis of NSPS, to represent the best existing technology in the nonferrous metals manufacturing category. Metals removal based on chemical precipitation, sedimentation, and multimedia filtration technology is the basis for the NSPS limitations. In selecting NSPS, EPA recognizes that new plants have the opportunity to implement the best and most efficient manufacturing processes and treatment technologies available.

PSES is not being promulgated for this subcategory because there are no existing indirect dischargers in the secondary mercury subcategory. For PSNS, the Agency selected end-of-pipe treatment techniques equivalent to NSPS.

BCT is not being promulgated because there are no direct dischargers.

The mass limitations for NSPS and PSNS are presented in Section II.

SECTION II

CONCLUSIONS

EPA has divided the secondary mercury subcategory into three subdivisions or building blocks for the purpose of effluent limitations and standards. These subdivisions are:

(a) Spent battery electrolyte,
(b) Acid wash and rinse water, and
(c) Furnace wet air pollution control.

BPT is not being promulgated because there are no direct dischargers in the secondary mercury subcategory.

BAT is not being promulgated because there are no direct dischargers in the secondary mercury subcategory.

NSPS are promulgated based on the performance achievable by the application of chemical precipitation, sedimentation, and multimedia filtration technology. The following effluent standards are promulgated for new sources:

(a) Spent Battery Electrolyte NSPS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of mercury produced from batteries		
Lead	0.030	0.014
Mercury	0.016	0.006
TSS	1.590	1.272
pH	Within the range of 7.5 to 10.0 at all times	

(b) Acid Wash and Rinse Water NSPS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of mercury washed and rinsed		
Lead	0.00056	0.00026
Mercury	0.00030	0.00012
TSS	0.03000	0.02400
pH	Within the range of 7.5 to 10.0 at all times	

(c) Furnace Wet Air Pollution Control NSPS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of mercury processed through furnace		
Lead	0.000	0.000
Mercury	0.000	0.000
TSS	0.000	0.000
pH	Within the range of 7.5 to 10.0 at all times	

PSES is not being promulgated because there are no indirect dischargers in the secondary mercury subcategory.

PSNS are promulgated based on the performance achievable by the application of chemical precipitation. sedimentation, and multimedia filtration technology. The following pretreatment standards are promulgated for new sources:

(a) Spent Battery Electrolyte PSNS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of mercury produced from batteries		
Lead	0.030	0.014
Mercury	0.016	0.006

(b) Acid Wash and Rinse Water PSNS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of mercury washed and rinsed		
Lead	0.00056	0.00026
Mercury	0.00030	0.00012

(c) Furnace Wet Air Pollution Control PSNS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of mercury processed through furnace		
Lead	0.000	0.000
Mercury	0.000	0.000

BCT is not being promulgated for the secondary mercury subcategory at this time.

SECTION III

SUBCATEGORY PROFILE

This section of the secondary mercury supplement describes the raw materials and processes used in producing secondary mercury and presents a profile of the secondary mercury plants identified in this study. For a discussion of the purpose, authority, and methodology for this study, and a general description of the nonferrous metals manufacturing category, refer to Section III of Vol. I.

Mercury is used in numerous agricultural, chemical and electrical applications. Mercury is used extensively in the chemical industry, particularly in the production of chlorine and caustic soda. Mercury compounds are also used extensively in paints and as catalysts. Agricultural uses of mercury include germicides for seed protection and weed control, and fungicidal fruit sprays. Electrical applications include low-pressure and high pressure mercury vapor lamps, power control switches, and drycell batteries. Other uses are in barometers, thermometers, as a vibration damper, and as a coolant. Mercury produced from secondary sources is used in many applications, such as those described above.

DESCRIPTION OF SECONDARY MERCURY PRODUCTION

The production of secondary mercury can be divided into three distinct stages: separation of gross impurities, distillation, and acid washing. The actual processes used in each stage vary with the type and purity of the raw material used. The secondary mercury production process is presented schematically in Figure III-1 (page 2876) and is described below.

RAW MATERIALS

Mercury can be reclaimed from a variety of raw materials. including thermometers, switches, filters. controls, zinc and silver amalgams, mercuric oxide battery cells, and other types of scrap. Secondary mercury annually supplies the United States with approximately 20 percent of domestic requirements. Several plants refining secondary mercury also refine prime virgin mercury. Although prime virgin mercury can be considered to be a primary raw material, its refining is included with secondary mercury, because it is refined on-site with secondary mercury using the same equipment and production processes.

SEPARATION OF GROSS IMPURITIES

Depending on the type of raw material being processed, gross impurities, such as glass from mercury thermometers, or spent electrolyte from mercuric oxide battery cells, may have to be

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separated from the mercury. The separation of gross impurities must occur prior to distilling the mercury. Raw materials such as thermometers, switches, filters, controls, and zinc and silver amalgams may be separated from their gross impurities by roasting in a furnace. The mercury is separated from impurities by vaporizing it, and then recovering mercury by condensation The nonvolatilized solids are removed from the furnace after all the mercury has been removed. A water scrubber may be used to control air emissions from the mercury furnace and condenser, and the scrubber may have a discharge from it.

Before mercury can be recovered from mercuric oxide battery cells, the battery electrolyte must be removed. On a small scale, this is most likely accomplished by manually draining the spent electrolyte from each cell. Spent electrolyte removed in this step is a waste stream.

DISTILLATION

Mercury distillation columns, also known as retorts stills, or kettles, are used to produce high-purity mercury. No wastewater is generated by this process. A typical distillation process consists of charging raw, impure mercury into the bottom of a still and heating the charge to a prescribed temperature, some. what less than the boiling point of mercury, 356.9°C. While heating the charge, air may be bubbled through the still in order to oxidize metallic impurities, such as lead, zinc, cadmium, copper or tin. When the charge reaches the critical temperature. the mercury begins to vaporize, and the mercury is recovered in an overhead, water cooled condensing system. Mercury distillation may be run batchwise or continuously, and in both cases it can be considered a dry process. None of the water used in the condensing coils contacts the mercury.

Multiple distillation units may be operated in series to produce high purity (approximately 99.999999 percent) mercury. Like the single distillation process, no wastewater is generated by multiple distillation units.

ACID WASHING

Another method for further purifying mercury is acid washing and rinsing. In this method, a small amount of dilute nitric acid is used to wash the distilled mercury product, and then a small amount of distilled water is used to wash the residual acid from the mercury product. Mercury of 99.9 percent purity can be produced in this manner. The acid wash and rinse water may be discharged from this process as a waste stream.

PROCESS WASTEWATER SOURCES

Although a variety of processes are involved in secondary mercury production the process wastewater sources can be subdivided as follows:

1. Spent battery electrolyte,
2. Acid wash and rinse water, and
3. Furnace wet air pollution control.

OTHER WASTEWATER SOURCES

There are other wastewater streams associated with the secondary mercury subcategory. These wastewater streams may include stormwater runoff, maintenance and cleanup water, and noncontact cooling water. These waste streams are not considered as a part of this rulemaking. EPA believes that the flows and pollutant loadings associated with these waste streams are insignificant relative to the waste streams selected, or are best handled by the appropriate permit authority on a case-by-case basis under authority of Section 402 of the Clean Water Act.

AGE, PRODUCTION, AND PROCESS PROFILE

Figure III-2 (page 2877) shows the locations of the four secondary mercury plants operating in the United States. Two of the four plants are located near the industrial centers of the Northeast, one is in Illinois, and one in California.

Table III-1 (page 2874) shows the relative age and discharge status of the mercury plants and illustrates that all the plants were built after World War II. The average plant age is 30 years old. From Table III-2 (page 2875), it can be seen that two plants produce between 50 and 100 tons per year of metal, while one plant produces less than 25 tons per year. Mean production is about 55 tons per year.

Table III-3 (page 2875) provides a summary of the number of plants generating wastewater for the waste streams associated with various processes and the number of plants with the process.

Table III-1

INITIAL OPERATING YEAR (RANGE) SUMMARY OF PLANTS IN THE SECONDARY MERCURY SUBCATEGORY BY DISCHARGE TYPE

Type of Plant	Initial Operating Year (Range) (Plant Age in Years)			
	1982-1968 (0-15)	1967-1958 (16-25)	1957-1948 (26-35)	Total
Direct	0	0	0	0
Indirect	0	0	0	0
Zero	0	0	2	2
Dry	0	1	0	2*
TOTAL	0	0	1	4

---

*One plant did not report initial operating year

Table III-2

PRODUCTION RANGES FOR THE SECONDARY MERCURY SUBCATEGORY

Type of Plant	Mercury Production Range for 1982 0-25 (tons/yr)	25-50 (tons/yr)	50-100 (tons/yr)	Total Number of Plants
Direct	0	0	0	0
Indirect	0	0	0	0
Zero	1	0	1	2
Dry	0	0	1	2*
				4

* One plant did not report mercury production.

Table III-3

SUMMARY OF SUBCATEGORY PROCESSES AND ASSOCIATED WASTE STREAMS

Process or Waste Stream	Number of Plants With Process or Waste Stream	Number of Plants Reporting Generation of Wastewater*
Spent battery electrolyte	1	1
Furnace wet air pollution control	1	0
Distillation	4	0
Acid wash and rinse water	1	1

*Through reuse or evaporation practices, a plant may "generate" a wastewater from a particular process but not discharge it.

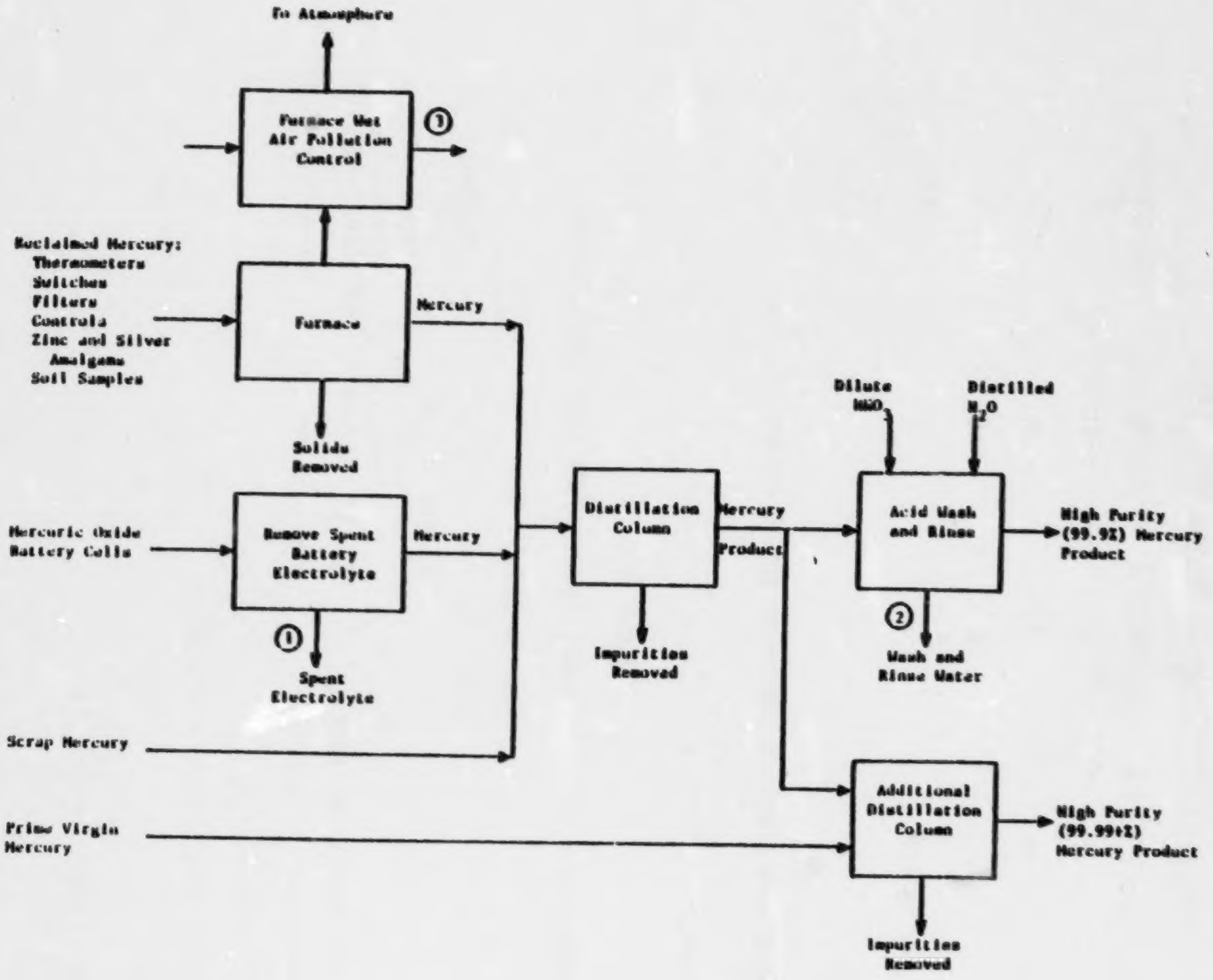
To Atmosphere
Furnace Wet Air Pollution Control
③
Reclaimed Mercury:
Thermometers
Switches
Filters
Controls
Zinc and Silver Amalgams
Soil Samples
Furnace
Mercury
Solids Removed
Mercuric Oxide Battery Cells
Remove Spent Battery Electrolyte
Mercury
①
Spent Electrolyte
Scrap Mercury
Prime Virgin Mercury
Distillation Column
Impurities Removed
Mercury Product
Dilute HNO$_3$
Distilled H$_2$O
Acid Wash and Rinse
High Purity (99.9%) Mercury Product
②
Wash and Rinse Water
Additional Distillation Column
High Purity (99.99+%) Mercury Product
Impurities Removed

Figure III-1
SECONDARY MERCURY PRODUCTION PROCESS

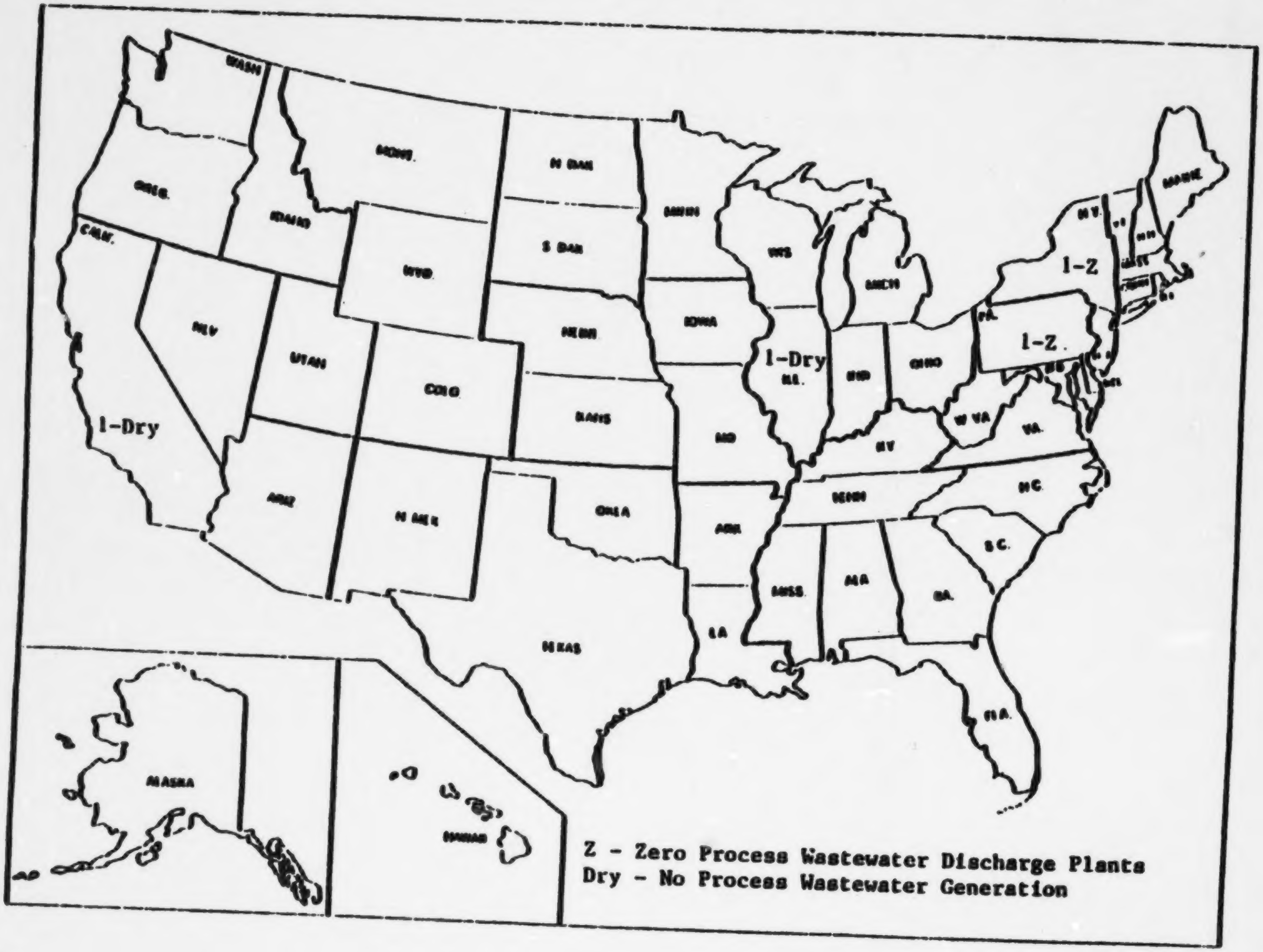
1-Z
1-Z.
1-Dry
1-Dry
W VA
VA.
N.C.
S.C.
GA.
FLA.
LA
PA.
N.Y.
CALIF.
Z - Zero Process Wastewater Discharge Plants
Dry - No Process Wastewater Generation

Figure III-2
GEOGRAPHIC LOCATIONS OF THE SECONDARY MERCURY SUBCATEGORY PLANTS

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SECTION IV

SUBCATEGORIZATION

This section summarizes the factors considered during the designation of the secondary mercury subcategory and its related subdivisions. Production normalizing parameters for each subdivision will also be discussed.

FACTORS CONSIDERED IN SUBDIVIDING THE SECONDARY MERCURY SUBCATEGORY

The general factors for subcategorization listed previously were each evaluated when considering subdivision of the secondary mercury subcategory. In the discussion that follows, the factors will be described as they pertain to this subcategory.

The rationale for considering subdivision of the secondary mercury subcategory is based primarily on differences in the production processes and raw materials used. Within this subcategory, a number of different operations are performed, which may or may not have a water use or discharge, and which may require the establishment of separate effluent limitations. While secondary mercury is considered a single subcategory, a more thorough examination of the production processes has illustrated the need for limitations and standards based on specific flow allowances for the following subdivisions:

1. Spent battery electrolyte,
2. Acid wash and rinse water, and
3. Furnace wet air pollution control.

These subdivisions follow directly from differences within the three distinct production states of secondary mercury: separation of gross impurities, distillation, and additional purification. A secondary mercury plant may have one, two, or all three of these production states.

Separation of gross impurities such as spent battery electrolyte or glass from thermometers gives rise to the first and third subdivisions: spent battery electrolyte and furnace wet air pollution control. A plant which recovers mercury from mercuric oxide battery cells must first drain the spent electrolyte from the cells. This wastewater may be discharged. A plant which recovers mercury from recycled thermometers, switches, filters, and amalgams may remove the mercury from the unwanted solids by vaporizing mercury in a furnace. After condensing the product mercury, the air emissions may be controlled with a scrubber. The furnace scrubber may have a discharge, and this creates the need for the third subdivision.

Additional purification of the mercury product gives rise to the second subdivision: acid wash and rinse water. After distilling the mercury, it may be washed with acid and rinsed with water to increase its purity. The acid wash and rinse water may be discharged as a waste stream.

OTHER FACTORS

The other factors considered in this evaluation were shown to be inappropriate bases for subdivision. Air pollution control methods, treatment costs, and total energy requirements are functions of the selected subcategorization factors -- metal product, raw materials, and production processes. Therefore, they are not independent factors and do not affect the subcategorization which has been applied. Certain other factors, such as plant age, plant size, and the number of employees were also evaluated and determined to be inappropriate for use as bases for subdivision of secondary mercury plants.

PRODUCTION NORMALIZING PARAMETERS

As discussed previously, the effluent limitations and standards developed in this document establish mass limitations for the discharge of specific pollutant parameters. To allow these regulations to be applied to plants with various production capacities, the mass of pollutant discharged must be related to a unit of production. This factor is known as the production normalizing parameter (PNP).

In general, for each production process which has a wastewater associated with it, the actual mass of mercury product or intermediate produced will be used as the PNP Thus, the PNPs for the three subdivisions are as follows:

Subdivision	PNP
1. Spent battery electrolyte	mercury produced from batteries
2. Acid wash and rinse water	mercury washed and rinsed
3. Furnace wet air pollution control	mercury processed through furnace

Other PNPs were considered. The use of production capacity instead of actual production was eliminated from consideration because the mass of the pollutant produced is more a function of true production than of installed capacity.

SECTION V

WATER USE AND WASTEWATER CHARACTERISTICS

This section describes the characteristics of the wastewaters associated with the secondary mercury subcategory. Water use and discharge rates are explained and then summarized in tables at the end of this section. Data used to characterize the wastewaters are presented. Finally, the specific source, water use and discharge flows, and wastewater characteristics for each separate wastewater source are discussed.

The two principal data sources were used in the development of effluent limitations and standards for this subcategory are data collection portfolios (dcp) and field sampling results. Data collection portfolios contain information regarding wastewater flows and production levels.

In order to quantify the pollutant discharge from secondary mercury plants, the levels of priority pollutants in the wastewaters must be known. Since field sampling was not performed at any plants in the secondary mercury subcategory, analytical data, presented in Section V of the supplement for the primary precious metals and mercury subcategory, were transferred from a primary mercury plant to characterize wastewater in the secondary mercury subcategory. In general, the samples were analyzed for two classes of pollutants (including 13 of the 126 priority pollutants): priority metal pollutants and criteria pollutants (which includes both conventional and nonconventional pollutants). Because the analytical standard for TCDD was judged to be too hazardous to be made generally available, samples were never analyzed for this pollutant. Samples were also never analyzed for asbestos or cyanide. There is no reason to expect that TCDD, asbestos, or cyanide would be present in secondary mercury wastewater.

As described in Section IV of this supplement, the secondary mercury subcategory has been divided into three wastewater source oriented subdivisions or building blocks, so that the promulgated regulation contains mass discharge limitations and standards for three manufacturing processes that discharge process wastewater. Differences in the wastewater characteristics associated with these subdivisions are to be expected. For this reason, wastewater streams corresponding to each subdivision are addressed separately in the discussions that follow. These wastewater sources are:

1. Spent battery electrolyte,
2. Acid wash and rinse water, and
3. Furnace wet air pollution control.

No additional sampling data for this subcategory were obtained from EPA sampling efforts or industry comments between proposal and promulgation. Characterization of secondary mercury subcategory wastewaters (Section V), and selection of pollutant parameters for limitation (Section VI) are based upon the same data used for proposal.

WASTEWATER FLOW RATES

Data supplied by dcp responses were evaluated, and two flow-to-production ratios, water use and wastewater discharge flow, were calculated for each stream. The two ratios are differentiated by the flow value used in calculation. Water use is defined as the volume of water or other fluid required for a given process per mass of mercury product and is therefore based on the sum of recycle and make-up flows to a given process. Wastewater flow discharged after pretreatment or recycle (if these are present) is used in calculating the production normalized flow -- the volume of wastewater discharged from a given process to further treatment, disposal, or discharge per mass of mercury produced. Differences between the water use and wastewater flows associated with a given stream result from recycle, evaporation, and carry-over on the product. The production values used in calculation correspond to the production normalizing parameter, PNP, assigned to each stream, as outlined in Section IV. As an example, acid wash and rinse water flow is related to the amount of mercury washed and rinsed. As such, the discharge rate is expressed in liters of acid wash and rinse water per metric ton of mercury washed and rinsed (gallons of acid wash and rinse water per ton of mercury washed and rinsed).

The production normalized discharge flows were compiled and statistically analyzed by stream type. These production normalized water use and discharge flows are presented by subdivision in Tables V-1 through V-3 (pages 2885 - 2886). Where appropriate, an attempt was made to identify factors that could account for variations in water use and discharge rates. These variations are discussed later in this section by subdivision. A similar analysis of factors affecting the wastewater flows is presented in Sections XI and XII where representative NSPS and pretreatment flows are selected for use in calculating the effluent limitations.

WASTEWATER CHARACTERISTICS DATA

Data used to characterize the various wastewaters associated with secondary mercury production come from two sources -- data collection portfolios and analytical data from field sampling trips.

DATA COLLECTION PORTFOLIOS

In the data collection portfolios, the mercury plants that generate wastewater were asked to specify the presence of priority pollutants in their wastewater. No plants indicated that any priority organic pollutants were present. However, one of the two plants stated that they either knew priority metals to be present or they believed the metals to be present. The responses for the metals and cyanide are summarized below:

Pollutant	Known Present	Believed Present
Antimony	0	0
Arsenic	0	0
Beryllium	0	0
Cadmium	0	0
Chromium	0	0
Copper	0	0
Cyanide	0	0
Lead	0	0
Mercury	1	1
Nickel	0	0
Selenium	0	0
Silver	0	0
Thallium	0	0
Zinc	0	0

FIELD SAMPLING DATA

In order to quantify the concentrations of pollutants present in wastewater from secondary mercury plants, wastewater samples were collected at one primary mercury plant, which roasts mercury ore to produce mercury metal. Analytical data from the primary mercury plant are presented in the supplement for the primary precious metals and mercury subcategory. Primary mercury and secondary mercury field sampling data are expected to show similar characteristics because of similarities in raw materials and production processes. Both plants roast or distill a mercury-containing raw material and use wet scrubbers to control emissions, and also wash their product to increase its purity.

WASTEWATER CHARACTERISTICS AND FLOWS BY SUBDIVISION

Since secondary mercury production involves three principal sources of wastewater and each has potentially different characteristics and flows, the wastewater characteristics and discharge rates corresponding to each subdivision will be described separately. A brief description of why the associated production processes generate a wastewater and explanations for variations of water use within each subdivision will also be discussed.

SPENT BATTERY ELECTROLYTE

One plant recovers mercury from mercuric oxide battery cells. The first step in this recovery is to drain the spent electrolyte from the cells. Spent battery electrolyte may be discharged as a wastewater stream. Production normalized water use and discharge rates for this waste stream are shown in Table V-1 (page 2885), in liters per metric ton of mercury produced from batteries. This subdivision is similar to spent battery electrolyte from lead batteries (see the battery cracking subdivision of the secondary lead subcategory), however, secondary mercury spent electrolyte is not expected to have similar pollutant characteristics nor similar production normalized flows.

Although spent battery electrolyte was not sampled, wastewater from the primary mercury industry should have similar characteristics to this waste stream. Spent battery electrolyte should contain treatable concentrations of priority metals, total suspended solids, and exhibit a low pH.

ACID WASH AND RINSE WATER

After recovering mercury in a distillation system, the product may be washed with dilute nitric acid and rinsed with distilled water in order to further purify it. Acid washing and water rinsing produces a high-purity (99.9 percent) mercury product, and also generates a wastewater stream which may be discharged. The production normalized water use and discharge rates for acid wash and rinse water are given in Table V-2 (page 2885) in liters per metric ton of mercury washed and rinsed.

Although acid wash and rinse water was not sampled, data from the primary mercury industry should be similar to this waste stream. Acid wash and rinse water should contain treatable concentrations of priority metals, total suspended solids, and exhibit a low pH.

FURNACE WET AIR POLLUTION CONTROL

One plant recovers mercury from sources such as thermometers, switches, contacts, and amalgams by heating the raw materials in a furnace in order to vaporize the mercury. After condensing the mercury product, air emissions from the furnace may be controlled with a wet scrubber. The furnace scrubber may have a discharge associated with it. Water use and discharge rates for furnace wet air pollution control are presented in Table V-3 (page 2886). Only one plant has this process and operates its scrubber at 100 percent recycle.

Table V-1

WATER USE AND DISCHARGE RATES FOR SPENT BATTERY ELECTROLYTE

(l/kkg of mercury produced from batteries)

Plant Code	Percent Recycle	Production Normalized Water Use	Production Normalized Discharge Flow
1161	0	106	106

Table V-2

WATER USE AND DISCHARGE RATES FOR ACID WASH AND RINSE WATER

(l/kkg of mercury washed and rinsed)

Plant Code	Percent Recycle	Production Normalized Water Use	Production Normalized Discharge Flow
1161	0	2.0	2.0

Table V-3

WATER USE AND DISCHARGE RATES FOR FURNACE WET AIR POLLUTION CONTROL

(l/kkg of mercury processed through furnace)

Plant Code	Percent Recycle	Production Normalized Water Use	Production Normalized Discharge Flow
1011	100	Unknown	0

SECTION VI

SELECTION OF POLLUTANT PARAMETERS

Although wastewater from secondary mercury facilities was not sampled, it should have similar characteristics to wastewater from a primary mercury facility. Analytical data from a primary mercury plant are presented in Section V of the supplement for primary precious metals and mercury. This section examines that data and discusses the selection or exclusion of pollutants for potential limitation.

The basis for the regulation of toxic and other pollutants along with a discussion of each pollutant selected for potential limitation is discussed in Section VI of the General Development Document. That discussion provides information concerning the nature of the pollutant (i.e., whether it is a naturally occurring substance, processed metal, or a manufactured compound); general physical properties and the form of the pollutant; toxic effects of the pollutant in humans and other animals; and behavior of the pollutant in POTW at the concentrations expected in industrial discharges.

The discussion that follows presents and briefly discusses the selection of conventional pollutants for effluent limitations. Also described is the analysis that was performed to select or exclude priority pollutants for further consideration for limitations and standards. Pollutants will be considered for limitation if they are present in concentrations treatable by the technologies considered in this analysis. The treatable concentrations used for the priority metals were the long-term performance values achievable by chemical precipitation, sedimentation, and filtration.

CONVENTIONAL POLLUTANT PARAMETERS

This study examined samples for the secondary mercury subcategory for three conventional pollutant parameters (oil and grease, total suspended solids, and pH).

CONVENTIONAL POLLUTANT PARAMETERS SELECTED

The conventional pollutants or pollutant parameters selected for limitation in this subcategory are:

total suspended solids (TSS)
pH

No nonconventional pollutants or pollutant parameters are selected for limitation in this subcategory.

TSS are expected to be present in secondary mercury wastewaters in concentrations exceeding that achievable by identified treatment technologies (2.6 mg/l). In the primary mercury plant's wastewater, TSS concentrations ranged from 4 mg/l to 3,700 mg/l. Furthermore, most of the specific methods used to remove toxic metals do so by converting these metals to precipitates, and these toxic-metal-containing precipitates should not be discharged. Meeting a limitation on total suspended solids helps ensure that removal of these precipitated toxic metals has been effective. For these reasons, total suspended solids are selected for limitation in this subcategory.

Spent battery electrolyte and acid wash and rinse water are expected to have pH values less than pH 7.5, which is outside the pH 7.5 to 10 range considered desirable for discharge to receiving waters. Four of the six primary mercury wastewater samples had pH values between 2.3 and 2.6. Many deleterious effects are caused by extreme pH values or rapid changes in pH. Also, effective removal of toxic metals by precipitation requires careful control of pH. Since pH control within the desirable limits is readily attainable by available treatment, pH is selected for limitation in this subcategory.

TOXIC PRIORITY POLLUTANTS

Raw wastewater from secondary mercury plants was not sampled, however, raw wastewater samples from the primary mercury industry should be representative of the wastewater from secondary mercury plants. These data provide the basis for the categorization of specific pollutants, as discussed below. Treatment plant samples were not considered in the frequency count.

TOXIC POLLUTANTS NEVER DETECTED

The priority pollutants listed in Table VI-1 (page 2891) were not detected or not analyzed for in any raw wastewater samples; therefore, they are not selected for consideration in establishing limitations.

TOXIC POLLUTANTS NEVER FOUND ABOVE THEIR ANALYTICAL QUANTIFICATION CONCENTRATION

The priority pollutants listed below were never found above their analytical quantification concentration in any raw wastewater samples; therefore, they are not selected for consideration in establishing limitations.

114. antimony
117. beryllium
119. chromium (Total)
120. copper
124. nickel
125. selenium
126. silver

TOXIC POLLUTANTS PRESENT BELOW CONCENTRATIONS ACHIEVABLE BY TREATMENT

The pollutants listed below are not selected for consideration in establishing limitations because they were not found in any raw wastewater samples above concentrations considered achievable by existing or available treatment technologies. These pollutants are discussed individually following the list.

115. arsenic
118. cadmium

Arsenic was detected above the quantification concentration but below the treatable concentration in one sample analyzed. The sample contained 0.32 mg/l arsenic which is below the 0.34 mg/l treatable concentration. Therefore, arsenic is not selected for limitation.

Cadmium was detected above the quantification concentration in one sample analyzed. The sample indicated a cadmium concentration of 0.04 mg/l. This is below the 0.049 mg/l treatable concentration, thus cadmium is not selected for limitation.

TOXIC POLLUTANTS SELECTED FOR FURTHER CONSIDERATION IN ESTABLISHING LIMITATIONS AND STANDARDS

The priority pollutants listed below are selected for further consideration in establishing limitations and standards for this subcategory. The toxic pollutants selected for further consideration for limitation are each discussed following the list.

122. lead
123. mercury
127. thallium
128. zinc

Lead was detected above its treatable concentration of 0.08 mg/l in one sample. This sample indicated a lead concentration of 22 mg/l. Lead is also expected to be present in wastewaters from this industry because it is a contaminant of the raw materials used for mercury recovery. Thus, lead is selected for further consideration for limitation.

Mercury was present above treatable concentrations in the wastewater from this industry. One sample showed a concentration of 360 mg/l of mercury. In the recovery of secondary mercury, mercury contacts various aqueous streams in which it is partially soluble. For these reasons, mercury is selected for further consideration for limitation.

Thallium was detected above its treatable concentration of 0.34 mg/l in one sample. This sample indicated 0.61 mg/l of thallium. Thus, thallium is selected for consideration for limitation.

Zinc was detected above treatable concentrations in one sample indicating 0.73 mg/l. Treatable concentration for zinc is 0.23 mg/l. Zinc is also expected to be present in wastewaters from this industry because it is present in batteries which are used as raw materials for secondary mercury recovery. Therefore, zinc is selected for further consideration for limitation.

TABLE VI-1

TOXIC POLLUTANTS NEVER DETECTED

1. acenaphthene*
2. acrolein*
3. acrylonitrile*
4. benzene*
5. benzidine*
6. carbon tetrachloride (tetrachloromethane)*
7. chlorobenzene*
8. 1,2,4-trichlorobenzene*
9. hexachlorobenzene*
10. 1,2-dichloroethane*
11. 1,1,1-trichloroethane*
12. hexachloroethane*
13. 1,1-dichloroethane*
14. 1,1,2-trichloroethane*
15. 1,1,2,2-tetrachloroethane*
16. chloroethane*
17. bis (chloromethyl) ether (Deleted)*
18. bis (2-chloroethyl) ether*
19. 2-chloroethyl vinyl ether (mixed)*
20. 2-chloronaphthalene*
21. 2,4,6-trichlorophenol*
22. parachlorometa cresol*
23. chloroform (trichloromethane)*
24. 2-chlorophenol*
25. 1,2-dichlorooenzene*
26. 1,3-dichlorobenzene*
27. 1,4'-dichlorobenzene*
28. 3.3 -dichlorobenzidine*
29. 1.1-dichloroethylene*
30. 1,2-trans-dichloroethylene*
31. 2,4-dichlorophenol*
32. 1,2-dichloropropane*
33. 1.2-dichloropropylene (1.3-dichloropropene)*
34. 2,4-dimethylphenol*
35. 2,4-dinitrotoluene*
36. 2,6-dinitrotoluene*
37. 1,2-diphenylhydrazine*
38. ethylbenzene*
39. fluoranthene*
40. 4-chlorophenyl phenyl ether*
41. 4-bromophenyl phenyl ether*
42. bis(2-chloroisopropyl) ether*
43. bis(2-choroerhoxy) methane*
44. methylene chloride (dichloromethane)*
45. methyl chloride (chloromethane)*
46. methyl bromide (bromomethane)*
47. bromoform (tribromomethane)*

TABLE VI-1 (Continued)

TOXIC POLLUTANTS NEVER DETECTED

48. dichlorobromomethane*
49. trichlorofluoromethane (Deleted)*
50. dichlorodifluoromethane (Delered)*
51. chlorodibromomethane*
52. hexachloroutadiene*
53. hexachlorocyclopentadiene*
54. isophorone*
55. naphthalene*
56. nitrobenzene*
57. 2-nitrophenol*
58. 4-nitrophenol*
59. 2,4-dinitrophenol*
60. 4,6-dinitro-o-cresol*
61. N-nitrosodimethylamine*
62. N.nitrosodiphenylamine*
63. N-nitrosodi-n-propylamine*
64. pentachlorophenol*
65. phenol*
66. bis(2-ethylhexyl) phthalate*
67. butyl benzyl phthalate*
68. di.n-butyl phthalate*
69. di-n-octyl phthalate*
70. diethyl phthalate*
71. dimethyl phthalate*
72 benzo (a)anthracene (1,2-benzanthracene)*
73. benzo (a)pyrene (3,4-benzopyrene)*
74. 3,4-benzofluoranthene*
75. benzo(k)fluoranthane (11,12-benzofluoranthene)*
76. chrysene*
77. acenaphthylene*
78. anthracene*
79. benzo(ghi)perylene (1,11-benzoperylene)*
80. fluorene*
81. phenanthrene*
82. dibenzo (a,h)anthracene (1,2.5,6-dibenzanthracene)*
83. indeno (1.2,3-cd)pyrene (w,e,-c-phenylenepyrene)*
84. pyrene*
85. tetrachloroethylene*
86. toluene*
87. trichloroethylene*
88. vinyl chloride (chloroethylene)*
89. aldrin*
90. dieldrin*
91. chlordane (technical mixture and metabolites)*
92. 4,4'-DDT*
93. 4,4'-DDE(p,p'DDX)*
94. 4,4'-DDD(p,p'TDE)*

TABLE VI-1 (Continued)

TOXIC POLLUTANTS NEVER DETECTED

95. Alpha-endosulfan*
96. Beta-endosulfan*
97. endosulfan sulfate*
98. endrin*
99. endrin aldehyde*
100. heptachlor*
101. heptachlor epoxide*
102. Alpha-BHC*
103. Beta-BHC-*
104. Gamma-BHC (lindane)*
105. Delta-BHC*
106. PCB-1242 (ArochIor 1242)*
107. PCB-1254 (Arochlor 1254)*
108. PCB-1221 (Arochlor 1221)*
109. PCB-1Z?Z (Arochlor 1232)*
110. PCB-1Z?8 (Arochlor 1248)*
111. PCB-1Z60 (Arochlor 1260)*
112. PCB-1016 (Arochlor 1016)*
113. toxaphene*
116. asbestos (Fibrous)
121. cyanide (Total)*
129. 2,3,7,8-tetra chlorodibenzo-p-dioxin (TCDD)

*We did not analyze for these pollutants in samples of raw wastewater from this subcategory. These pollutants are not believed to be present based on the Agency's best engineering judgment which includes consideration of raw materials and process operations.

SECTION VII

CONTROL AND TREATMENT TECHNOLOGIES

The preceding sections of this supplement discussed the sources, flows, and characteristics of the wastewaters from secondary mercury plants. This section summarizes the description of these wastewaters and indicates the treatment technologies which are currently practiced in the secondary mercury subcategory for each waste stream. Secondly, this section presents the control and treatment technology options which were examined by the Agency for possible application to the secondary mercury subcategory.

CURRENT CONTROL AND TREATMENT PRACTICES

This section presents a summary of the control and treatment technologies that are currently being applied to each of the sources generating wastewater in this subcategory. As discussed in Section V, wastewater associated with the secondary mercury subcategory is characterized by the presence of the toxic metal pollutants and suspended solids. This analysis is supported by the raw (untreated) wastewater data presented for primary mercury sources as well as raw materials and production processes as shown in Section VI. Generally, these pollutants are present in each of the waste streams at concentrations above treatability, and these waste streams are commonly combined for treatment. Construction of one wastewater treatment system for combined treatment allows plants to take advantage of economic scale and in some instances to combine streams of different alkalinity to reduce treatment chemical requirements. No plants in this subcategory currently treat their wastewater. One plant employs contractor disposal of their wastewater, and one plant employs 100 percent recycle of scrubber liquor. The options selected for consideration for NSPS and pretreatment based on combined treatment of these compatible waste streams will be summarized toward the end of this section.

SPENT BATTERY ELECTROLYTE

Mercury may be reclaimed from recycled mercuric oxide battery cells. Before distilling the mercury contained in the battery, the spent electrolyte must be drained. One plant processes recycled batteries, and has their spent battery electrolyte hauled away by an approved contractor.

ACID WASH AND RINSE WATER

After recovering mercury from recycled batteries by distillation, the mercury product may be further purified. Purification is effected by washing the mercury with dilute nitric acid, and then rinsing it with water. One plant generates an acid wash and rinse wastewater stream in this manner, and disposes of it by having a contractor haul it away.

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FURNACE WET AIR POLLUTION CONTROL

Mercury may be reclaimed from scrap such as thermometers, switches, filters, controls, amalgams, and soil samples by vaporizing the mercury in a furnace. After recovering the vaporized mercury by condensation, the air emissions from the furnace may be controlled with a wet scrubber. One plant practices furnace wet air pollution control, and recycles 100 percent of the scrubber liquor. There is no liquid effluent from this process.

CONTROL AND TREATMENT OPTIONS

The Agency examined two control and treatment technology options that are applicable to the secondary mercury subcategory. The options selected for evaluation represent a combination of end-of-pipe treatment technologies. The effectiveness of these technologies is detailed in Section VII of Vol. I.

OPTION A

Option A for the secondary mercury subcategory requires control and treatment technologies to reduce the discharge of wastewater pollutant mass.

The Option A treatment scheme consists of chemical precipitation and sedimentation technology. Specifically, lime or some other alkaline compound is used to precipitate metal ions as metal hydroxides. The metal hydroxides and suspended solids settle out and the sludge is collected. Vacuum filtration is used to dewater sludge.

OPTION C

Option C for the secondary mercury subcategory consists of all control and treatment requirements of Option A (chemical precipitation and sedimentation) plus multimedia filtration technology added at the end of the Option A treatment scheme. Multimedia filtration is used to remove suspended solids, including precipitates of metals, beyond the concentration attainable by gravity sedimentation. The filter suggested is of the gravity, mixed media type, although other forms of filters, such as rapid sand filters or pressure filters would perform satisfactorily. The addition of filters also provides consistent removal during periods in which there are rapid increases in flows or loadings of pollutants to the treatment system.

SECTION VIII

COSTS, ENERGY, AND NONWATER QUALITY ASPECTS

This section presents a summary of compliance costs for the secondary mercury subcategory and a description of the treatment options and subcategory-specific assumptions used to develop these estimates. Together with the estimated pollutant removal performance presented in Section XI of this supplement, these cost estimates provide a basis for evaluating each regulatory option. These cost estimates are also used in determining the probable economic impact of regulation on the subcategory at different pollutant discharge levels.

As there are no existing direct or indirect dischargers in this subcategory, plant-by-plant compliance cost estimation was not appropriate. Rather, based on analysis of the production sampling data from plants presently in the subcategory, compliance costs for new source model plants were estimated for each of the considered treatment options. Since no new information or data were received from industry comments between proposal and promulgation, new source model plant compliance costs for promulgation are the same as for proposal.

In addition, this section addresses nonwater quality environmental impacts of wastewater treatment and control alternatives, including air pollution, solid wastes, and energy requirements, which are specific to the secondary mercury subcategory.

TREATMENT OPTIONS FOR NEW SOURCES

As discussed in Section VII, two treatment options have been developed and considered in proposing standards for the secondary mercury subcategory. These options are summarized below and schematically presented in Figures XI-1 and XI-2 Pages 2914 - 2915).

OPTION A

The Option A treatment scheme consists of chemical precipitation and sedimentation technology.

OPTION C

Option C for the secondary mercury subcategory consists of all control and treatment requirements of Option A (chemical precipitation and sedimentation) plus multimedia filtration technology added at the end of the Option A treatment scheme.

COST METHODOLOGY

A detailed discussion of the methodology used to develop the compliance costs is presented in Section VIII of Vol. I. Projected compliance costs for new source model plants in the secondary mercury subcategory have been determined and are presented in the administrative record supporting this regulation. The costs developed for the promulgated regulation are presented in Table VIII-1 (page 2901) for model new sources in the secondary mercury subcategory.

Each of the general assumptions used to develop compliance costs is presented in Section VIII of Vol. I. Each subcategory contains a unique set of waste streams requiring certain subcategory-specific assumptions to develop compliance costs. Three major assumptions relevant to the cost estimation of new source model plants in the secondary mercury subcategory are discussed briefly below.

(1) Operating hours are assumed to be 2,000 hours per year (8 hrs/day, 250 days/yr).

(2) Treatment of the furnace wet air pollution control wastewater stream is not included in the cost estimate because it is considered a process step in the recovery of mercury from furnace scrubber liquor.

(3) Pollutant concentration data for the two wastewater streams included in the treatment scheme were transferred from the calciner venturi scrubber in the primary mercury subcategory.

NONWATER QUALITY ASPECTS

Nonwater quality impacts specific to the secondary mercury subcategory, including energy requirements, solid waste, and air pollution are discussed below.

ENERGY REQUIREMENTS

The methodology used for determining the energy requirements for the various options is discussed in Section VIII of the General Development Document. Energy requirements for new source model plants are estimated at 2,300 kwh/yr for Option A and 3,500 kwh/yr for Option C. Option C energy requirements increase over those for Option A because filtration is being added as an end-of-pipe treatment technology. Both options represent less than one percent of a typical existing plant's energy usage. It is therefore expected that the energy requirements of the treatment options considered will have no significant impact on total plant energy consumption for new sources.

SOLID WASTE

Sludge generated in the secondary mercury subcategory is due to the precipitation of metal hydroxides and carbonates using lime. Sludges associated with the secondary mercury subcategory will necessarily contain quantities of toxic metal pollutants. Wastes generated by secondary metal industries can be regulated as hazardous. However, the Agency examined the solid wastes that would be generated at secondary nonferrous metals manufacturing plants by the suggested treatment technologies and believes they are not hazardous wastes under the Agency's regulations implementing Section 3001 of the Resource Conservation and Recovery Act. None of the secondary mercury wastes are listed specifically as hazardous, nor are they likely to exhibit a characteristic of hazardous waste. This judgment is made based on the recommended technology of lime precipitation and filtration. By the addition of a small (5-10%) excess of lime during treatment, similar sludges, specifically toxic metal-bearing sludges, generated by other industries such as the iron and steel industry passed the Extraction Procedure (EP) toxicity test. See 40 CFR $261.24. Thus, the Agency believes that the wastewater sludges will similarly not be EP toxic if the recommended technology is applied.

Although it is the Agency's view that solid wastes generated as a result of these guidelines are not expected to be hazardous generators of these wastes must test the waste to determine if the wastes meet any of the characteristics of hazardous waste (see 40 CFR 262.11).

If these wastes should be identified or are listed as hazardous, they will come within the scope of RCRA's "cradle to grave" hazardous waste management program, requiring regulation from the point of generation to point of final disposition. EPA's generator standards would require generators of hazardous nonferrous metals manufacturing wastes to meet containerization, labeling, recordkeeping, and reporting requirements; if plants dispose of hazardous wastes off-site, they would have to prepare a manifest which would track the movement of the wastes from the generator's premises to a permitted off-site treatment, storage, or disposal facility. See 40 CFR 262.20 45 FR 33142 (May 19, 1980), as amended at 45 FR 86973 (December 31, 1980). The transporter regulations require transporters of hazardous wastes to comply with the manifest system to assure that the wastes are delivered to a permitted facility. See 40 CFR 263.20 45 FR 33151 (May 19, 1980), as amended at 45 FR 86973 (December 31, 1980). Finally, RCRA regulations establish standards for hazardous waste treatment, storage, and disposal facilities allowed to receive such wastes. See 40 CFR Part 464 46 FR 2802 (January 12, 1981), 47 FR 32274 (July 26, 1982).

Even if these wastes are not identified as hazardous, they still must be disposed of in compliance with the Subtitle D open dumping standards, implementing 4004 of RCRA. See 40 FR 53438 (September 13, 1979). It is estimated that a new source model plant in the secondary mercury subcategory would generate an estimated 12 kg/yr of sludge when implementing the promulgated NSPS treatment technology, based on a production level of 50 metric tons of mercury per year. The Agency has calculated as part of the costs for wastewater treatment the cost of hauling and disposing of solid wastes.

AIR POLLUTION

There is no reason to believe that any substantial air pollution problems will result from implementation of chemical precipitation, sedimentation, and multimedia filtration. These technologies transfer pollutants to solid waste and are not likely to transfer pollutants to air.

TABLE VIII-1

COST OF COMPLIANCE FOR NEW SOURCE MODEL PLANTS IN THE SECONDARY MERCURY SUBCATEGORY*

(March, 1982 Dollars)

Option	Total Required Capital Cost	Total Annual Cost
A	1,237	3,070
C	3,162	4,530

*Based on production of 50 metric tons of mercury per year.

SECTION IX

BEST PRACTICABLE CONTROL TECHNOLOGY CURRENTLY AVAILABLE

The wastewater handling practices of the plants within the secondary mercury subcategory were studied. BPT was found to be not applicable to this industrial subcategory. Existing performance of plants in the secondary mercury subcategory is such that no discharge of process wastewater is presently practiced. This is achieved by 100 percent recycle on-site or by contractor disposal of process wastewater, or is a result of a production process that generates no process wastewater. Since there are no discharge from secondary mercury producers, BPT and BAT mass limitations, with their corresponding treatment technologies, need not be promulgated for this subcategory. Rather, the secondary mercury subcategory will be regulated under New Source Performance Standards in Section XI, and Pretreatment Standards for New Sources in Section XII.

SECTION X

BEST AVAILABLE TECHNOLOGY ECONOMICALLY ACHIEVABLE

As described in Section IX, BAT is not applicable to the secondary mercury subcategory because no plants in the data base discharge process wastewater. Regulation of the secondary mercury subcategory is covered in Section XI under New Source Performance Standards, and Section XII under Pretreatment Standards for New Sources.

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SECTION XI

NEW SOURCE PERFORMANCE STANDARDS

This section describes the technologies for treatment of wastewater from new sources and presents mass discharge standards for regulated pollutants for NSPS in the secondary mercury subcategory, based on the selected treatment technology.

TECHNICAL APPROACH TO NSPS

New source performance standards are based on the most effective and beneficial technologies currently available. The Agency reviewed and evaluated a wide range of technology options, and elected to examine two technology options, applied to combined wastewater streams, which could be applied to the secondary mercury subcategory as alternatives for the basis of NSPS.

Treatment technologies considered for the NSPS options are summarized below:

OPTION A (Figure XI-1, page 2914) is based on:

- Chemical precipitation and sedimentation

OPTION C (Figure XI-2 page 2915) is based on:

- Chemical precipitation and sedimentation
- Multimedia filtration

As explained in Section IV, the secondary mercury subcategory has been subdivided into three potential wastewater sources. Since the water use, discharge rates, and pollutant characteristics of each of these wastewaters is potentially unique, effluent limitations will be developed for each of the three subdivisions.

For each of the building blocks, a specific approach was followed for the development of NSPS. The first requirement to calculate these limitations is to account for production and flow variability from plant to plant. Therefore, a unit of production or production normalizing parameter (PNP) was determined for each wastewater stream which could then be related to the flow from the process to determine a production normalized flow. Selection of the PNP for each process element is discussed in Section IV. Each process within the subcategory was then analyzed to determine (1) which subdivisions were present, (2) the specific flow rates generated for each subdivision, and (3) the specific production normalized flows for each subdivision. This analysis is discussed in detail in Section V. Nonprocess wastewaters such as rainfall runoff and noncontact cooling water are not considered in the analysis.

Production normalized flows for each subdivision were analyzed to determine which flow was to be used as part of the basis for

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NSPS. The selected flow (sometimes referred to as the NSPS regulatory flow or NSPS discharge flow) reflects the water use controls which are practiced within the subcategory. The NSPS normalized flow is based on the average of all applicable data. Nothing was found to indicate that the wastewater flows and characteristics of new plants would not be similar to those from existing plants, since the processes used by new sources are not expected to differ from those used at existing sources.

For the development of NSPS, mass loadings were calculated for each wastewater source or building block. This calculation was made on a stream-by-stream basis, primarily because plants in this subcategory may perform one or more of the operations in various combinations. The mass loadings (milligrams of pollutant per metric ton of production unit - mg/kkg) were calculated by multiplying the NSPS normalized flow (l/kkg) by the treatment effectiveness concentration using the NSPS treatment system (mg/l) for each pollutant parameter to be limited under NSPS.

The mass loadings which are allowed under NSPS for each plant will be the sum of the individual mass loadings for the various building blocks which are found at particular plants. Accordingly, all the wastewater generated within a plant may be combined for treatment in a single or common treatment system, but the effluent limitations for these combined wastewaters are based on the various wastewater sources which actually contribute to the combined flow. This method accounts for the variety of combinations of wastewater sources and production processes which may be found at secondary mercury plants.

The Agency usually establishes wastewater limitations in terms of mass rather than concentration. This approach prevents the use of dilution as a treatment method (except for controlling pH). The production normalized wastewater flow (l/kkg) is a link between the production operations and the effluent limitations. The pollutant discharge attributable to each operation can be calculated from the normalized flow and effluent concentration achievable by the treatment technology and summed to derive an appropriate limitation for each plant.

INDUSTRY COST AND POLLUTANT REMOVAL ESTIMATES

As one means of evaluating each technology option, EPA developed estimates of the pollutant removals and the compliance costs associated with each option. The methodologies are described below. For both pollutant removals and compliance costs, estimates reported at promulgation are the same as those reported at proposal. This is because new information or data were not received from industry during the comment period between proposal and promulgation.

POLLUTANT REMOVAL ESTIMATES

Since there are no existing discharging plants in the secondary mercury subcategory, the pollutant removal analysis was carried out for new source model plants.

A complete description of the methodology used to calculate the estimated pollutant removal achieved by the application of the various treatment options is presented in Section X of Vol. I. In short, sampling data used to characterize the major waste streams considered for regulation was production normalized for each unit operation (i.e., mass of pollutant generated per mass of product manufactured). This value, referred to as the raw waste was used to estimate the mass of toxic pollutants generated within the secondary mercury subcategory. The pollutant removal estimates were calculated for each plant by first estimating the total mass of each- pollutant in the untreated wastewater. This was calculated by multiplying the raw waste values by the corresponding new source model plant production value for that stream and then summing these values for each pollutant for every stream generated by the plant.

Next, the volume of wastewater discharged after the application of each treatment option was estimated for each operation at each plant by comparing the actual discharge to the regulatory flow. The smaller of the two values was selected and summed with the other plant flows. The mass of pollutant discharged was then estimated by multiplying the achievable concentration values attainable with the option (mg/l) by the estimated volume of process wastewater discharged by the subcategory. The mass of pollutant removed is the difference between the estimated mass of pollutant generated within the subcategory and the mass of pollutant discharged after application of the treatment option. The pollutant removal estimates for the new source model plant in the secondary mercury subcategory are presented in Table XI-1 (page 2911).

COMPLIANCE COSTS

In estimating subcategory-wide compliance costs, the first step was to develop a cost estimation model, relating the total costs associated with installation and operation of wastewater treatment technologies to plant process wastewater discharge. EPA applied the model to each plant. The plant's investment and operating costs are determined by what treatment it has in place and by its individual process wastewater discharge flow. As discussed above, this flow is either the actual or the BDT regulatory flow, whichever is lesser. The final step was to annualize the capital costs, and to sum the annualized capital costs, and the operating and maintenance costs for each plant, yielding the cost of compliance for the subcategory. The compliance costs associated with each option are presented in Table XI-2 (page 2912) for new source model plants in the secondary mercury subcategory. These costs were used in assessing economic achievability.

NSPS OPTION SELECTION - PROPOSAL

EPA selected Option C for the proposed NSPS, which includes chemical precipitation, sedimentation, and filtration.

The pollutants proposed for limitation under NSPS were lead, mercury, total suspended solids, and pH. The estimated capital cost of proposed NSPS was $3,162 and the estimated annual cost was $4,530 (1982 dollars) for new facilities.

NSPS OPTION SELECTION - PROMULGATION

The Agency received no industry comments on the proposed regulation for the secondary mercury subcategory. Therefore, the promulgated regulation is equivalent to the proposed regulation for the secondary mercury subcategory.

EPA is promulgating NSPS based on the best available demonstrated technology for the secondary mercury subcategory which is equivalent to Option C (chemical precipitation, sedimentation, and multimedia filtration). This selection is based on an economic analysis of the two NSPS options and their impact on the cost of building new production plants within the scope of this subcategory. ERA believes the promulgated NSPS are economically achievable, and that they are not a barrier to entry of new plants into this subcategory. The estimated capital cost of promulgated NSPS for new source model plants is $3,162, and the estimated annual cost is $4,530 (1982 dollars), based on production of 50 metric tons of mercury per year. The end-of-pipe treatment configuration for Option C is presented in Figure XI-2 (page 2915).

WASTEWATER DISCHARGE RATES

A NSPS discharge rate is calculated for each subdivision based on the average of the flows of the existing plants, as determined from analysis of dcp. The discharge rate is used with the achievable treatment concentrations to determine NSPS. Since the discharge rate may be different for each wastewater source, separate production normalized discharge rates for each of the three wastewater sources are discussed below and summarized in Table XI-3 (page 2912). The discharge rates are normalized on a production basis by relating the amount of wastewater generated to the mass of the product which is produced by the process associated with the waste stream in question. These production normalizing parameters, or PNPs, are also listed in Table XI-3.

Section V of this document further describes the discharge flow rates and presents production normalized water use and discharge rates for each plant by subdivision in Tables V-1 through V-3 (pages 2885 - 2886). For all subdivisions, the proposed and promulgated NSPS discharge rates are equivalent. These rates are discussed below.

SPENT BATTERY ELECTROLYTE

The proposed and promulgated NSPS wastewater discharge rate for spent battery electrolyte is 106 liters per kkg of mercury produced from batteries. This rate is allocated only for those plants which drain electrolyte from mercuric oxide batteries prior to recovering mercury. Water use and wastewater discharge rates are presented in Table V-1 (page 2885). One plant drains spent battery electrolyte, and generates 106 l/kkg.

ACID WASH AND RINSE WATER

The proposed and promulgated NSPS wastewater discharge rate for acid wash and rinse water is 2.0 liters per kkg of mercury washed and rinsed. This rate is allocated only for those plants which further purify their mercury product by washing with acid and then rinsing with water. Water use and wastewater discharge rates are presented in Table V-2 (page 2885). One plant further purifies their mercury product in this manner, and generates 2.0 l/kkg.

FURNACE WET AIR POLLUTION CONTROL

No NSPS wastewater discharge rate for furnace wet air pollution control is provided based on 100 percent recycle of furnace scrubber water, as demonstrated at the one plant operating this process. This is shown in Table V-3 (page 2886).

REGULATED POLLUTANT PARAMETERS

The raw wastewater concentrations from individual operations and the subcategory as a whole were examined to select certain pollutant parameters for limitation. This examination and evaluation was presented in Section VI. A total of four pollutants or pollutant parameters are selected for limitation under NSPS and are listed below:

122. lead
123. mercury
TSS
pH

The Agency has chosen not to regulate all four priority pollutants selected in Section VI for further consideration.

The high cost associated with analysis for priority metal pollutants has prompted EPA to develop an alternative method for regulating and monitoring priority pollutant discharges from the nonferrous metals manufacturing category. Rather than developing specific effluent mass limitations and standards for each of the priority metals found in treatable concentrations in the raw wastewater from a given subcategory, the Agency is promulgating effluent mass limitations only for those pollutants generated in the greatest quantities as shown by the pollutant removal analysis.

By establishing limitations and standards for certain toxic metal pollutants, dischargers will attain the same degree of control over toxic metal pollutants as they would have been required to achieve had all the priority metal pollutants been directly limited.

This approach is technically justified since the treatable concentrations used for chemical precipitation and sedimentation technology are based on optimized treatment for concomitant multiple metals removal. Thus, even though metals have somewhat different theoretical solubilities, they will be removed at very nearly the same rate in a chemical precipitation and sedimentation treatment system operated for multiple metals removal. The mass limits established for lead and mercury will ensure that thallium and zinc, the other two priority metals selected for further consideration, will be adequately removed by a lime and settle unit.

NEW SOURCE PERFORMANCE STANDARDS

The treatable concentrations achievable by application of the promulgated NSPS are discussed in Section VII of Vol. I and summarized there in Table VII-21 (page 248). These treatable concentrations (both one day maximum and monthly aver-age values) are multiplied by the NSPS normalized discharge flows summarized in Table XI-3 (page 2912) to calculate the mass of pollutants allowed to be discharged per mass of product. The results of these calculations in milligrams of pollutant per kilogram of product represent the NSPS effluent standards and are presented in Table XI-4 (page 2913) for each individual waste stream.

Table XI-1

POLLUTANT REMOVAL ESTIMATES FOR NEW SOURCE MODEL PLANTS*

Pollutant	Raw Waste (kg/yr)	Option A Discharge (kg/yr)	Option A Removed (kg/yr)	Option C Discharge (kg/yr)	Option C Removed (kg/yr)
Antimony	0	0	0	0	0
Arsenic	0.0017	0.0017	0	0.0017	0
Cadmium	0.0002	0.0002	0	0.0002	0
Chromium (Total)	0	0	0	0	0
Copper	0	0	0	0	0
Lead	0.0119	0.0006	0.0112	0.0004	0.0114
Mercury	1.9440	0.0003	1.9437	0.0002	1.9438
Nickel	0	0	0	0	0
Selenium	0	0	0	0	0
Silver	0	0	0	0	0
Thallium	0.0033	0.0027	0.0006	0.0018	0.0015
Zinc	0.0039	0.0018	0.0022	0.0012	0.0027
TOTAL PRIORITY POLLUTANTS	1.9651	0.0074	1.9577	0.0056	1.9594
TSS	0.4320	0.0646	0.3674	0.0140	0.4180
TOTAL CONVENTIONALS	0.4320	0.0646	0.3674	0.0140	0.4180
TOTAL POLLUTANTS	2.3971	0.0720	2.3250	0.0196	2.3774

*Based on production of 50 metric tons mercury per year.

TABLE XI-2

COST OF COMPLIANCE FOR NEW SOURCE MODEL PLANTS IN THE SECONDARY MERCURY SUBCATEGORY*

(March, 1982 Dollars)

Option	Total Required Capital Cost	Total Annual Cost
A	1,237	3,070
C	3,162	4,530

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*Based on production of 50 metric tons of mercury per year.

TABLE XI-3

NSPS WASTEWATER DISCHARGE RATES FOR THE SECONDARY MERCURY SUBCATEGORY

Wastewater Stream	NSPS Normalized Discharge Rate l/kkg	gal/ton	Production Normalized Parameter
Spent battery electrolyte	106	25.5	mercury produced from batteries
Acid wash and rinse water	2.0	0.5	mercury washed and rinsed
Furnace wet air pollution	0	0	mercury control processed through furnace

TABLE XI-4

NSPS FOR THE SECONDARY MERCURY SUBCATEGORY

(a) Spent Battery Electrolyte NSPS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of mercury produced from batteries		
*Lead	0.030	0.014
*Mercury	0.016	0.006
Thallium	0.148	0.065
Zinc	0.108	0.045
*TSS	1.590	1.272
*pH	Within the range of 7.5 to 10.0 at all times	

(b) Acid Wash and Rinse Water NSPS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of mercury washed and rinsed		
*Lead	0.00056	0.00026
*Mercury	0.00030	0.00012
Thallium	0.00280	0.00122
Zinc	0.00204	0.00084
*TSS	0.03000	0.02400
*pH	Within the range of 7.5 to 10.0 at all times	

(c) Furnace Wet Air Pollution Control

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of mercury control processed through furnace		
*Lead	0.000	0.000
*Mercury	0.000	0.000
Thallium	0.000	0.000
Zinc	0.000	0.000
*TSS	0.000	0.000
*pH	Within the range of 7.5 to 10.0 at all times	

*Regulated Pollutant

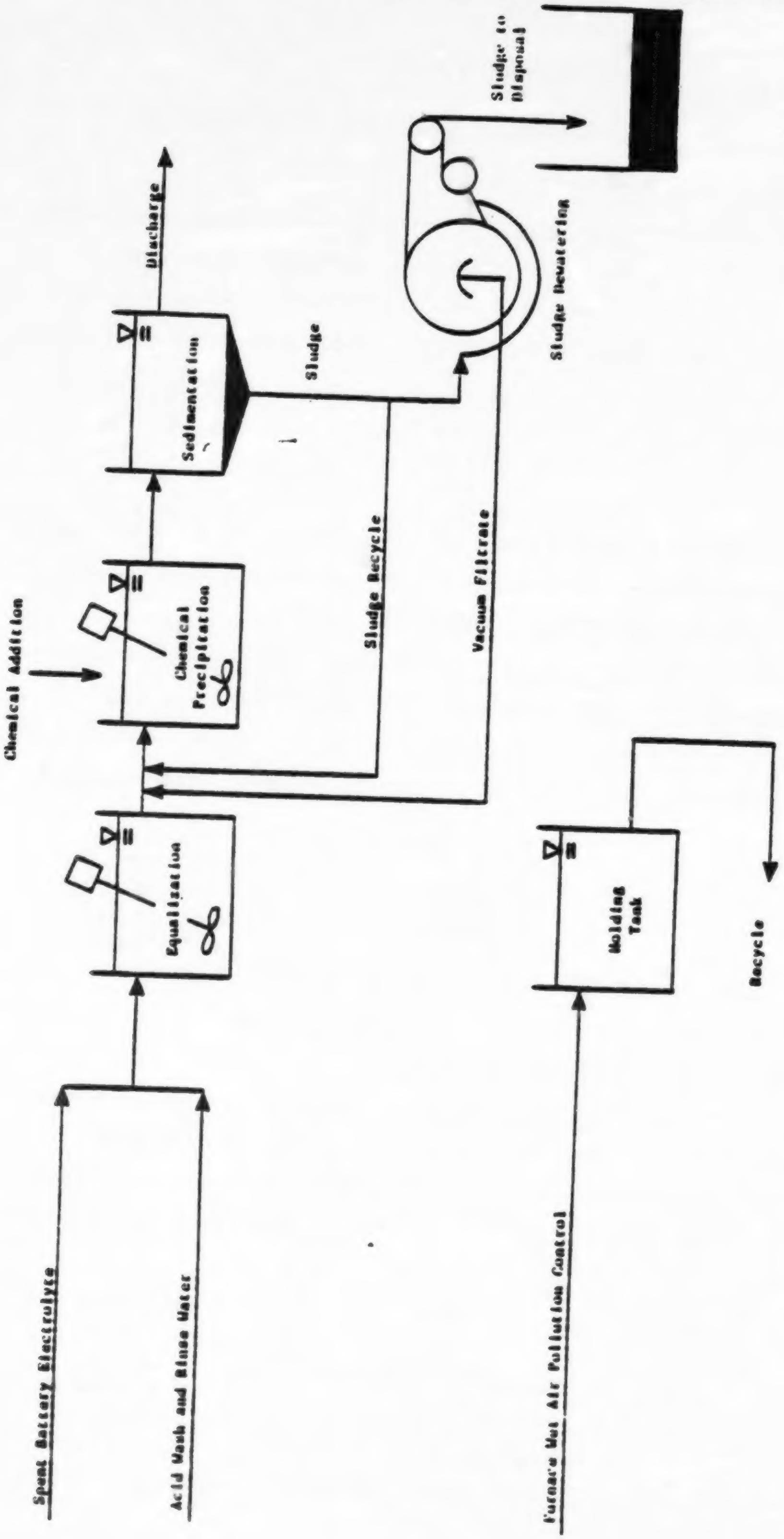
Spent Battery Electrolyte
Acid Wash and Rinse Water
Furnace Wet Air Pollution Control
Equalization
Chemical Addition
Chemical Precipitation
Sedimentation
Discharge
Sludge
Sludge Recycle
Vacuum Filtrate
Sludge Dewatering
Sludge to Disposal
Holding Tank
Recycle

Figure XI-1

NSPS TREATMENT SCHEME FOR OPTION A

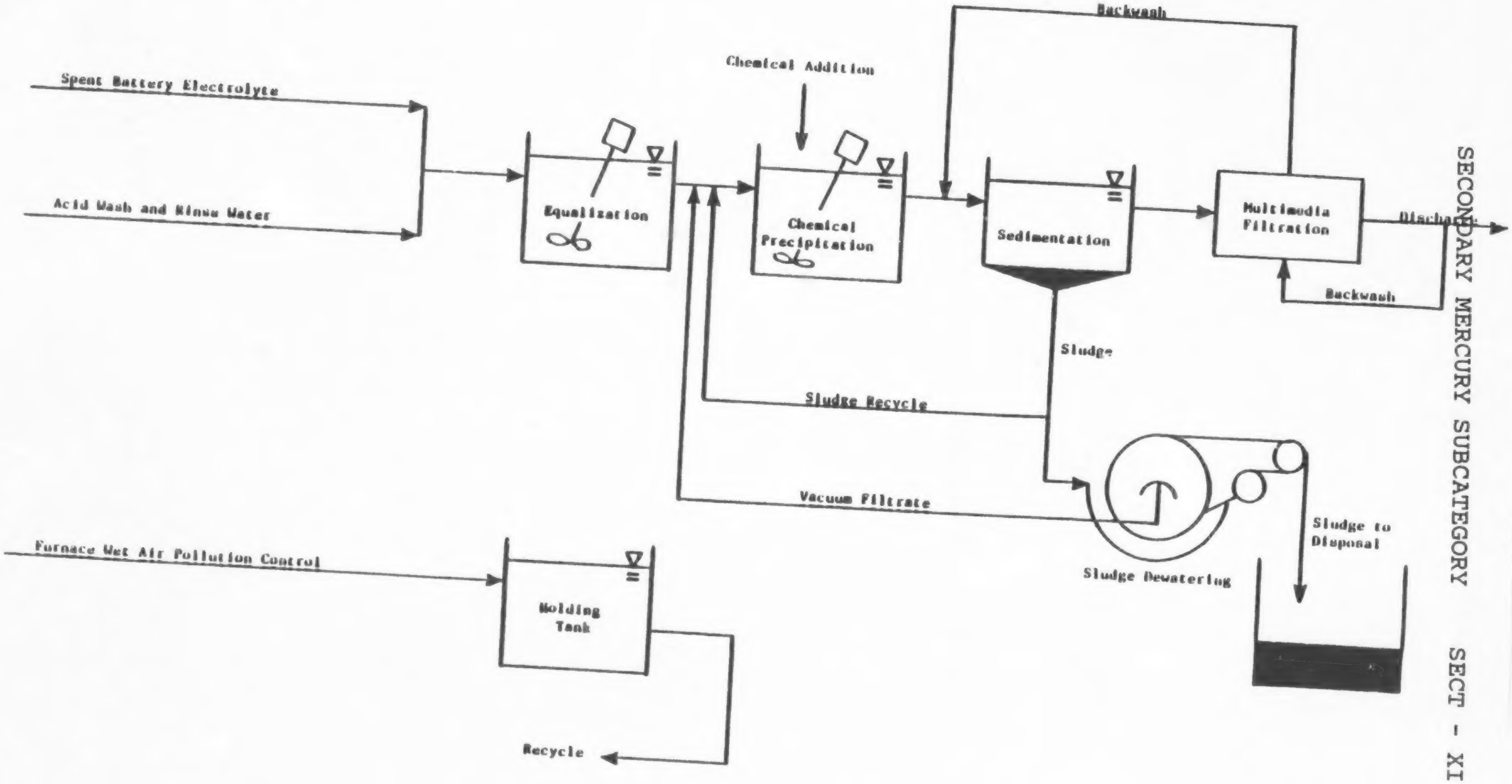
Spent Battery Electrolyte
Acid Wash and Rinse Water
Equalization
Chemical Addition
Chemical Precipitation
Backwash
Sedimentation
Multimedia Filtration
Discharge
Backwash
Sludge
Sludge Recycle
Vacuum Filtrate
Sludge Dewatering
Sludge to Disposal
Furnace Wet Air Pollution Control
Holding Tank
Recycle

Figure XI-2

NSPS TREATMENT SCHEME FOR OPTION C

SECTION XII

PRETREATMENT STANDARDS

This section describes the control and treatment technologies for pretreatment of process wastewaters from sources in the secondary mercury subcategory. Pretreatment standards for regulated pollutants are presented based on the selected control and treatment technology. Pretreatment standards for existing sources (PSES) will not be promulgated for the secondary mercury subcategory because there are no existing indirect dischargers in this subcategory. However, pretreatment standards for new sources (PSNS) for this subcategory will be promulgated.

TECHNICAL APPROACH TO PRETREATMENT

Before proposing and promulgating pretreatment standards, the Agency examines whether the pollutants discharged by the industry pass through the POTW or interfere with the POTW operation or its chosen sludge disposal practices. In determining whether pollutants pass through a well-operated POTW achieving secondary treatment, the Agency compares the percentage of a pollutant removed by POTW with the percentage removed by direct dischargers applying the best available technology economically achievable. A pollutant is deemed to pass through the POTW when the average percentage removed nationwide by well-operated POTW meeting secondary treatment requirements is less than the percentage removed by direct dischargers complying with BAT effluent limitations guidelines for that pollutant. (See generally, 46 FR at 9415-16 (January 28, 1981).)

This definition of pass-through satisfies two competing objectives set by Congress: (1) that standards for indirect discharg-ers be equivalent to standards for direct dischargers while at the same time, (2) that the treatment capability and performance of the POTW be recognized and taken into account in regulating the discharge of pollutants from indirect dischargers.

The Agency compares percentage removal rather than the mass or concentration of pollutants discharged because the latter would not take into account the mass of pollutants discharged to the POTW from non-industrial sources or the dilution of the pollutants in the POTW effluent to lower concentrations due to the addition of large amounts of non-industrial wastewater.

PRETREATMENT STANDARDS FOR NEW SOURCES

Options for pretreatment of wastewaters from new sources are based on increasing the effectiveness of end-of-pipe treatment technologies. All in-plant changes and applicable end-of-pipe treatment processes have been discussed previously in Section XI. The options for PSNS, therefore, are the same as the NSPS options discussed in Section XI.

A description of each option is presented in Section XI, while a more detailed discussion, including pollutants controlled by each treatment process, is presented in Section VII of Vol. I.

Treatment technologies considered for the PSNS options are:

OPTION A

- Chemical precipitation and sedimentation

OPTION C

- Chemical precipitation and sedimentation
- Multimedia filtration

PSNS OPTION SELECTION

Option C (chemical precipitation, sedimentation, and multimedia filtration) has been selected as the treatment technology for the proposed and promulgated pretreatment standards for new sources (PSNS) on the basis that it achieves effective removal of toxic pollutants at a reasonable cost. In addition, filtration is demonstrated in the nonferrous metals manufacturing category at 25 plants, and will not result in adverse economic impacts.

The wastewater discharge rates for promulgated PSNS are identical to the promulgated NSPS discharge rates for each waste stream. The PSNS discharge rates are shown in Table XII-1 (page 2920). No additional flow reduction measures for PSNS are feasible beyond the flow allowances given for NSPS.

REGULATED POLLUTANT PARAMETERS

The toxic pollutants selected for limitation, in accordance with the rationale of Sections VI and XI, are identical to those selected for limitation for NSPS. It is necessary to promulgate PSNS to prevent the pass-through of lead and mercury, which are the limited pollutants. The toxic pollutants are removed by a well operated POTW achieving secondary treatment at an average of 59 percent, while PSNS level technology removes approximately 99 percent.

PRETREATMENT STANDARDS FOR NEW SOURCES

Pretreatment standards for new sources are based on the treatable concentrations from the selected treatment technology (Option C), and the discharge rates determined in Section XI for NSPS. A mass of pollutant per mass of product (mg/kg) allocation is given for each subdivision within the subcategory. This pollutant allocation is based on the product of the treatable concentration from the promulgated treatment (mg/l) and the production normalized wastewater discharge rate (l/kkg). The achievable treatment concentrations for NSPS are identical to those for PSNS. These concentrations are listed in Table VII-21 (page 248) of Vol. I. PSNS are presented in Table XII-2 (page 2921).

TABLE XII-1

PSNS WASTEWATER DISCHARGE RATES FOR THE SECONDARY MERCURY SUBCATEGORY

Wastewater Stream	PSNS Normalized Discharge Rate l/kkg	PSNS Normalized Discharge Rate gal/ton	Production Normalized Parameter
Spent battery electrolyte	106	25.5	mercury produced from batteries
Acid wash and rinse water	2.0	0.5	mercury washed and rinsed
Furnace wet air pollution control	0	0	mercury control processed through furnace

Table XII-2

PSNS FOR THE SECONDARY MERCURY SUBCATEGORY

(a) Spent Battery Electrolyte PSNS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of mercury produced from batteries		
*Lead	0.030	0.014
*Mercury	0.016	0.006
Thallium	0.148	0.065
Zinc	0.108	0.045

(b) Acid Wash and Rinse Water PSNS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of mercury washed and rinsed		
*Lead	0.00056	0.00026
*Mercury	0.00030	0.00012
Thallium	0.00280	0.00122
Zinc	0.00204	0.00084

(c) Furnace Wet Air Pollution Control PSNS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of mercury control processed through furnace		
*Lead	0.000	0.000
*Mercury	0.000	0.000
Thallium	0.000	0.000
Zinc	0.000	0.000

*Regulated Pollutant

SECTION XIII

BEST CONVENTIONAL POLLUTANT CONTROL TECHNOLOGY

EPA is not promulgating best conventional pollutant control technology (BCT) for the secondary mercury subcategory at this time.

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